UNIVERSITY OF ALBERTA

EDUCATIONAL RESEARCHERS USING REAL-TIME VIDEOCONFERENCING TO COLLABORATE: THOUGHTS AND FEELINGS SHARED

By

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ABSTRACT

This study explored three research questions surrounding the real-time collaboration of educational researchers within a high-bandwidth videoconference environment. Qualitative data were collected using purposive sampling of known experts within the fields of educational research and videoconference collaboration. Four criteria were established and seventeen participants interviewed. All seventeen interviews were transcribed and categorized for data analysis.

This study presents the comments of the participants on the strengths and weaknesses of collaborating within a videoconferencing environment. It demonstrates that videoconferencing has an effect on collaboration, and contends that videoconferencing can be an effective medium to disseminate information when used appropriately. A checklist of pedagogically-based strategies was developed after the data analysis in order to assist educational researchers who want to effectively and efficiently collaborate in a videoconference environment.

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CHAPTER ONE: OVERVIEW OF THE STUDY

Introduction

Videoconferencing is a form of video-mediated communication that has become more accessible and utilized due to increased reliability of its integrated technologies as well as an overall decrease in associated costs (Davis, 2002; Wainfan and Davis, 2004). There are many benefits to using videoconferencing as a means to communicate. Such benefits include broadening the reach of collaborative research and development initiatives, increasing responsiveness in assembling a meeting, and decreasing time management issues that are often associated with face-to-face meetings (Davis and Weinstein, 2002; Sonnenwald, Bolliger, Solomon, Hara & Cox, 2001; Wainfan and Davis, 2004).

> During this past decade, technologies have become more interactive, distributed, and collaborative....Through the marriage of technology and instruction, global networks have connected learners across time and space, resulting in a myriad of new learning communities (Bonk and King, 1998, p. 5).

Over the last few years, I have had the privilege of participating in various videoconference experiences during my time at the University of Alberta. Each videoconference experience was distinct as each videoconference session had differing agendas (e.g., collaboration, information gathering, research, etc.), had diverse personalities amongst the participants, as well as various assorted technologies integrated into each videoconference session. A memorable videoconference experience was my involvement in the Rural Advanced Community of Learners (RACOL) project.

The RACOL project aimed at delivering educational programs within the Fort Vermilion School Division in rural Alberta using broadband synchronous (occurring at the same time) and asynchronous (not occurring at the same time) delivery methods via a multipoint TCP/IP (Transmission Control Protocol/Internet Protocol) videoconference system. This school division was selected to participate in the project due to its rural location, its shortage of qualified teachers who could teach in specific subject areas, its existing distance education program, its willingness and readiness to participate, as well as the vision of the project's main investigators.

For the RACOL project to succeed, special videoconference classrooms were constructed based upon the needs of the learners, teachers and school division. These videoconference classrooms are called Virtual Presence Learning Environments (VPLE). Each VPLE is equipped with a variety of digital tools, consisting of a high quality videoconferencing system, audio conferencing system, electronic whiteboard, personal computers with high-speed Internet access, a visualizer, VCR, DVD/CD player, monitors, speakers and microphones (Figure 1). Each VPLE is capable of connecting via a WAN (Wide-Area Network) connection using the Alberta SuperNet—a high bandwidth network planned to connect all schools within Alberta.

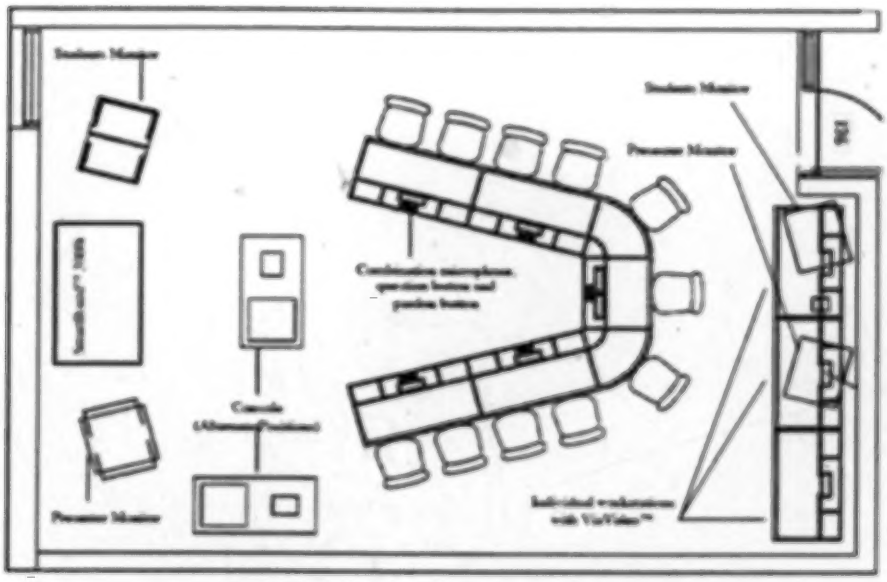

Figure 1: Schematic View of the Virtual Presence Learning Environment

Four teachers were scheduled to begin the RACOL project in the fall of 2003, thus requiring specifically designed professional development sessions. The aim of the professional development sessions was to provide these four teachers with the necessary tools so they could develop effective strategies in identifying the changing needs of the learner within this new teaching paradigm and to integrate the VPLEs' digital technologies into their respective teaching styles.

Before the teachers began teaching within the VPLEs, they received three days of extensive, face-to-face professional development in August 2003. The sessions were delivered by a professional development team consisting of faculty and graduate research assistants from the University of Alberta. I was fortunate to be included in this team and assisted in the delivery of the professional development sessions as well as the provision of continued professional

development support throughout the remaining school year. We met with these teachers via videoconference meetings and asynchronous communication.

From September 2003 through to June 2004, monthly videoconference meetings between the professional development team and the RACOL teachers were held. These meetings provided an opportunity for the teachers to communicate with each other as well as with the professional development team and other RACOL members. The communication at these videoconference meetings often revolved around the successes and challenges encountered using the VPLEs as a delivery method for instruction as well as the generation of new strategies for dealing with the challenges that were encountered.

This videoconferencing experience was a motivating factor behind choosing the direction of this study as it was rich and engaging. As time progressed however, I felt the need to broaden the scope of my research interests by exploring video-mediated communication between educational researchers within an institutional setting. This felt need was fostered by the work of my colleagues at the University of Alberta who were working on another videoconference research initiative.

The research my colleagues were working on was funded by the Social Sciences and Humanities Research Council of Canada (SSHRC) entitled, *High Bandwidth Synchronous Video-Based Communication: New Directions for Conducting Research at a Distance*. The objectives of this research were:

> 1) to support research that identifies and defines new conceptual and methodological perspectives, directions, challenges and priorities in conducting research, dissemination, and researcher training; and

2) to provide the means for researchers to collaborate on exploring innovative ways to develop and disseminate knowledge.

Their research provided the infrastructure by which educational researchers could use to collaborate in real-time using high-bandwidth, multipoint TCP/IP videoconferencing. Many of the educational researchers involved in this research initiative either used the University of Alberta's Cyberport or a videoconferencing system with similar functions and capabilities (Figure 2). The Cyberport is a specially designed videoconferencing system used for a variety of purposes including dissertation defences, collaborative meetings, and project status reports by faculty and staff at the University of Alberta.

Figure 2: Photograph of the University of Alberta's Cyberport

The Cyberport has a seating capacity of up to ten people and has the capability of using two high performance codecs: a Polycom VS 4000 codec that supports ISDN, H.320, and H.323, and an MPEG-2 codec.

Based on my experiences with the RACOL project and the research being carried out by my fellow colleagues at the University of Alberta, my research interests took a more definitive shape. The second objective of the SSHRC study was of particular interest to me because it provided educational researchers with a means by which to collaborate using real-time videoconferencing systems. It was my experience with RACOL, my colleague's research as well as a review of literature that finally formulated my research questions.

Research Questions

The objective of this study is to determine if videoconferencing is an effective medium for allowing educational researchers to collaborate. This objective will be met by collecting and assessing the experiences and thoughts of educational researchers who currently collaborate within videoconference environments at post-secondary institutions or research organizations. The data collection will focus on answering three main research questions:

1. What are the strengths of and the impediments to, collaborating within a high-bandwidth videoconference environment?
2. Is knowledge/information effectively disseminated within a collaborative videoconference environment?
3. Does videoconferencing change the ways in which educational researchers collaborate?

By answering these three questions, it was my aim to achieve this study's objective.

Significance of the Study

If videoconferencing proves to be either an ineffective or effective medium as evidenced by the commentary of educational researchers, I plan to identify explanations as to why this may be true. If the collected data demonstrate that videoconferencing has any effect on collaboration, I plan to create a list of pedagogically-based strategies for educational researchers to use in order to minimize the negative effects and maximize the positive effects and address implications that an effect may have on educational researchers currently using videoconferencing as a means to collaborate.

Delimitations

A major delimitation of this study was the utilization of a variation of non-probability, or purposive sampling. Purposive sampling is also referred to as expert sampling or even judgment sampling, wherein a researcher chooses participants who are known experts within a field of specialty or interest (Johnson & Christensen, 2000; Trochim, 2002). For this study, the field of specialty required of participants was expertise within educational research and experience with videoconference collaboration. A limitation of expert sampling is the inability to generalize data findings to a larger population (Johnson & Christensen, 2000). This limitation can be lessened by creating a criterion, or various criteria which potential participants must meet.

Four criteria were established to better ensure that participants were appropriately selected. Participants had to be educational researchers at either a post-secondary institution or research organization, possess a high level of

experience within videoconference environments and conducting educational research, demonstrate a high level of understanding of videoconference technologies, as well as be able to identify "best practices" behind effective collaboration within a videoconference environment. Considerable thought and research went into the creation of these criteria at the onset of the study, but none of them were validated. It is important to note though, that I did involve a known expert within the field of educational research and videoconferencing collaboration to assist in the creation of these four criteria. This expert also assisted in the generation of a contact list of potential participants that were known through professional associations, colleagues, shared research initiatives, or by reputation and who met these criteria.

Limitations

The first limitation of this study was the availability and willingness of the participants to participate in semi-structured interviews. All participants were initially contacted by email. This original communication outlined the particulars of the study and my personal contact information, and provided a consent form (Appendix C). Of the forty-six potential participants contacted, seventeen participants agreed to take part in this study. The seventeen consenting participants were scheduled for interviews within a one month period (June – July, 2004). Participants either replied to the email or contacted me by telephone to set up an interview time.

A second limitation was the willingness of the consenting participants to professionally and candidly discuss their experiences of collaborating within a

videoconference environment (Johnson and Christensen, 2000). I adhered to a high level of professional standards and interview protocols (ibid.). Trust and rapport-building initiatives were undertaken with each participant at the beginning of the interview by reviewing the particulars of the study and reminding each participant of his/her rights. Each participant was reminded that the interview was being recorded but their identity would remain confidential.

A third limitation was the type of data collected by the research method chosen (i.e., qualitative interviews). It could be argued that if another research method had been chosen, different results could have emerged. I chose a qualitative interview methodology in order to obtain a higher degree of quality responses as well as provide an opportunity for the participants to freely answer and elaborate on questions asked of them. "Qualitative interviews are also called in-depth interviews because they can be used to obtain in-depth information about a participant's thoughts, beliefs, knowledge, reasoning, motivations, and feelings about a topic" (Johnson and Christensen, 2000, p. 144).

Definition of Terms

Real-time Collaboration

Wainfan and Davis (2004) provided a comprehensive definition of *real-time* (virtual) collaboration.

> Virtual collaborations are collaborations in which the people working together are interdependent in their tasks, share responsibility for outcomes, are geographically dispersed, and rely on mediated, rather then face-to-face, communication to produce an outcome, such as shared understanding, evaluation, strategy, recommendation, decision, action plan, or other product (p. xi).

This definition addressed the fact that two or more people work in real-time in pursuit of a common goal despite geographically separation. "Collaboration arrangements can take many forms…from formal collaboration, founded on an explicit, common purpose agreed by the parties and based on explicit contracts, to informal collaborations involving more tacit and casual relationships" (Caloghioru, Ionnides and Vonortas, 2004, p. 15)

Real-time collaboration is an involved *process* that hinges upon active engagement by every attendee. "Real-time collaboration has two essential elements: people are directly involved with each other and simultaneous activity by these people is the essence of the interaction" (Aldred and Bonsall, 1995, p. 519). Real-time videoconference meetings are different then real-time collaboration within a videoconference environment in that meeting attendees are often disengaged, lack the shared vision or goals of other attendees and are not required to have responsibility of the shared outcome. Videoconference meetings for data and information transmission are often externally mandated whereas real-time collaboration within a videoconference environment consists of interested and willing participants.

Videoconferencing

For the purpose of this study, videoconferencing refers to high-bandwidth video and audio connection between two or more individuals located at a local site and a remote site.

> A videoconference is a live connection between people in separate locations for the purpose of communication, usually involving audio and often text as well as video. At its simplest,

> videoconferencing provides transmission of static images and text between two locations. At its most sophisticated, it provides transmission of full-motion video images and high-quality audio between multiple locations (SearchMobileComputing.com, 2005, ¶ 1).

The seamless exchange of video and audio feeds is a critical component of effective communication with videoconferencing.

Synchronous Communication

Educational researchers collaborate synchronously or asynchronously. Synchronous communication occurs simultaneously between two or more people who are face-to-face through conversation, various types of electronic-mediated systems, and/or through tools such as video and audio conferencing systems, text chat, or whiteboards (Barstow and Rothberg, 2002). Synchronous modes of communication are most prevalent within this study.

Asynchronous Communication

Asynchronous communication is the antonym to synchronous communication, meaning that communication or collaboration efforts do not occur in real-time. In asynchronous communication, the transmission of the electronic data is delayed or blocked which means that data is received at a later time or date by the receiver. "The term *asynchronous* is usually used to describe communications in which data can be transmitted intermittently rather then in a steady stream" (Webopedia, n.d., ¶ 1).

Structure of this Thesis

Chapter One provides an overview of this study. Chapter Two provides the history of videoconferencing, a description of various videoconference systems, the challenges and benefits of using videoconferencing, as well as a review of literature pertaining to videoconferencing and videoconference collaboration. Chapter Three discusses data collection methods, the particulars of participant selection, ethical considerations, and data analysis techniques used in this study. Chapter Four presents the data collected from the telephone, face-to-face and email interviews. Chapter Five discusses the data presented in Chapter Four, explores future research possibilities, and provides a list of pedagogically-based suggestions for videoconference collaborations. It also assesses whether or not the research objective was met.

CHAPTER TWO: REVIEW OF LITERATURE

Introduction

This chapter provides a review of literature pertaining to videoconferencing and real-time videoconference collaboration, an overview of the history of videoconferencing, an outline of various types of videoconferencing systems, and considers the challenges as well as the benefits of collaborating within a videoconference environment.

A gap emerged when reviewing literature pertaining to videoconferencing, collaboration and videoconference collaboration. There is an array of literature pertaining to videoconferencing (e.g., Davis and Weinstein, 2002) and real-time collaboration (e.g., Hardwick, 2000), but limited references to collaboration within a videoconference environment. I believe that in time more literature pertaining to videoconference collaboration will emerge thus becoming more beneficial for educational researchers using videoconferencing as a means of collaboration.

Videoconferencing

History of Videoconferencing

The origin of videoconferencing is traced back to the commercial telephone company AT&T's construction of the Picturephone test system in 1954 (Park, n.d.; Roberts, 2004). In 1964, AT&T publicly tested the Picturephone with at the World's Fair in New York. "To test it, the public was invited to place calls between special exhibits at Disneyland and the New York World's Fair. In both

locations, visitors were carefully interviewed afterward by a market research agency" (AT&T, 2005, ¶ 1). The Picturephone did not test well. The test subjects found the Picturephone too bulky, its controls not user-friendly, and the picture too small (ibid.).

Even though the Picturephone had poor reviews by the public at that time, AT&T offered their Picturephone for $160 per month in 1970 (Park, n.d.; Roberts, 2004). This relatively low cost helped inspire Ericsson to showcase the first trans-Atlantic video telephone call in 1971 and Nippon Telegraph and Telephone to establish a videoconference between Tokyo and Osaka offices in 1976 (ibid.).

The 1980s brought about mass commercialization and increased use of videoconferencing within the business sector.

> In 1982, Compression Labs introduces their VC system to the world for $250,000 with lines for $1,000 an hour. The system was huge and used enormous resources capable of tripping 15 amp circuit breakers. It was, however, the only working VC system available until PictureTel's VC hit the market in 1986 with their substantially cheaper $80,000 system with $100 per hour lines (Roberts, 2004, ¶ 4).

A major contribution to the use and popularity of videoconferencing was with the creation of the software program *CU-SeeMe* in 1992 (Park, n.d.; Roberts, 2004). This program

> Didn't have audio, [but] it was the best video system developed to that point. By 1993, the Mac program had multipoint capability, and in 1994, CU-SeeMe Mac was true video conferencing with audio. Recognizing the limitations of Mac compatibility in a Windows world, developers worked diligently to roll out the April 1994 CU-SeeMe for Windows (no audio), followed closely by the audio version, CU-SeeMe v0.66b1 for Windows in August of 1995 (Roberts, 2005, ¶ 7).

Since that time, major innovations within videoconferencing have occurred such as the launch of Microsoft NetMeeting, the launch of satellite video, and the development of standards for video conferencing coding by the International Telecommunications Union (ITU) in 1996 (Roberts, 2005).

Types of Videoconferencing

Videoconferencing is a means of video-mediated communication between two or more individuals over a geographical area. "At its simplest, videoconferencing provides transmission of static images and text between two locations. At its most sophisticated, it provides transmission of full-motion video images and high-quality audio between multiple locations" (SearchMobileComputing.com, 2003, ¶ 1).

There is a business case in support of the use of videoconferencing to collaborate (Davis and Weinstein, 2002). Davis and Weinstein argue that videoconferencing can reduce travel costs, increase productivity, provide an intermediary step between a telephone call and a face-to-face meeting, involve multiple sites simultaneously, allow participants to immediately interact, respond to an immediate communication need, provide a concise and focused communication tool, and allow for video archiving and the transmission of graphic, written or computer-generated materials.

There are two main types of videoconferencing: desktop videoconferencing (DVC), and integrated videoconferencing (IVC) involving broadcasts or group conferences (PicturePhone Direct, n.d.). Desktop

videoconferencing usually occurs at the personal computer, work station, or office of an individual. DVC requires a minimum of a microphone, video camera, speaker(s) and headphone(s), sound and video capability, an Internet connection, software and networking components (e.g., NetMeeting, CU-SeeMe) (Jonassen, Howland, Moore & Marra, 2003). Advantages of using DVC include the ability to integrate collaborative technologies (e.g., whiteboards, chat rooms, and email), the relatively straightforward installation and ease of use, the low purchasing prices, ability to share documents in real-time, the opportunity to transmit nonverbal communication, the reduction of travel time and travel costs, and the relatively high-quality video and audio streams (Czeck, 1997; Hearnshaw, 2000; Jennings & Bronack, 2001). DVC is intended for individual or small groups rather then convening large groups. This can be a limitation to using it. DVC is better suited for peer-to-peer collaboration or small group collaboration efforts.

Integrated videoconferencing systems (IVC), or group systems, are usually situated within a specially designed conference room equipped with a wide range of technologies. These rooms are often set up and operated by professional technicians. Corporations, universities and other larger organizations often prefer IVC as it accommodates larger groups. The group systems "often use dedicated transmission facilities that support the presentation of a better quality image at a cost that is significantly higher then that of a regular telephone call," that would be associated with ISDN (Angeiolillo, Blanchard, Israelski & Mane, 1997, p. 53). The advantages of using integrated videoconference systems include high-quality video and audio feeds, and the capacity to accommodate large groups.

Limitations of using IVC include the installation and maintenance costs as well as the technical expertise often required to operate it. Other limitations of using or relying upon IVC as a means of communication range from a lack of physical space for equipment, the need for higher quality equipment, the lack of camera control or hands-free equipment, not having the appropriate codec (*co*mpressor - *de*compressor), mismatched video standards and interoperability issues, audio delays and lip synchronization, the unpredictability of the attending group size, the individual characteristics of participants, the composition of the group, and transmission issues (Angeiolillo, Blanchard, Israelski & Mane, 1997; Olson & Olson, 1997).

Deciding whether to use DVC or IVC as a communications tool can depend on the equipment and time available, the purpose of the meeting, and the number and type of participants involved.

> An important thing to realize is that problems of transition from one site to multi-site meetings using video conferencing will occur and the benefits of broader participation may only be realized when time and resources are invested to notice what does not work, or what is not happening, and to explore and evaluate alternatives. This requires investigating and exploring ways the social and organizational infrastructure of the center and the technical infrastructure at the participating universities can better facilitate large group collaboration (Sonnenwald et al., 2001, p. 2).

The definition of videoconferencing that was outlined in Chapter One can now be broadened to include the technical components that comprise most videoconference systems. For instance, Alkan (n.d.) provided examples of technologies necessary to initiate a desktop videoconference.

> Video/voice detecting card or a digital camera that can be connected to the parallel port of the computer in order to convert

> video into digital format by receiving the video from an analog camera and receiving the voice from a microphone, voice card and a loudspeaker to repeat the received voice and a monitor to display the received video, communication tool like a modem, ISDN card or a similar network interface for transmitting and receiving the information, software that can realize document sharing and provide video/voice compression, multiplexing, assembling and management (¶ 4).

Supplemental technologies such as electronic whiteboards, data sharing software, chat rooms, specialized lighting, and so forth, can be integrated into either DVC or IVC systems (Maring, Schmid and Roark, 2003). The various technologies in a videoconferencing system depend largely on the purpose of the videoconference, the number of people involved, the timeline, available resources and the participant's experience with asynchronous/synchronous communication tools (Comp@ct, 2004).

Challenges and Benefits of Collaborating Within a Videoconference Environment

Videoconferencing can be used for a variety of purposes. Some of these purposes include progress and status report meetings, training, problem solving, reviews, and presentations (Boutte and Jones, 1996). Regardless of the purpose of the meeting, challenges and benefits of using videoconferencing for the purposes of collaboration exist.

A common challenge when collaborating within a videoconference environment is encountering technical difficulties with the technology. Such technical difficulties can lead to lost time as well as participant anxiety and frustration. Other challenges include the actual and associated purchase and maintenance costs, technical skills required to operate the videoconference

system, as well as the lack of effective interaction due to lack of pedagogical know-how (Freeman, 1998). "In general, video conferencing works best for groups of people who already now each other and are comfortable working together. Video may exaggerate problems between groups that have a high degree of conflict to begin with" (Boutte and Jones, 1996, p. 140).

Technical difficulties can originate from a variety of sources. One such source includes the standard by which the video is transmitted. ISDN (Integrated Services Digital Network), is a communications standard for sending voice, video, and data over digital telephone lines and/or telephone copper wires. To use ISDN for videoconferencing, an ISDN modem and an ISDN adapter are required (Microsoft, 2004). ISDN supports data transfer rates of up to 128 Kbps (128,000 bits per second).

> ISDN transmits data digitally and, as a result, is less susceptible to static and noise than analog transmissions. Analog modem connections must dedicate some bandwidth to error correction and retransmission. This overhead reduces the actual throughput. In contrast, an ISDN line can dedicate all its bandwidth to data transmission (Microsoft, 2004. ¶ 9).

One advantage of using ISDN, is that it is inexpensive to purchase. A disadvantage and thus a challenge for users is that it can be expensive to operate due to the long distance telephone bills associated with each videoconference meeting (Jang, Kelly, and Davis, January 2003). If there are technical problems with the ISDN, then the transmission of video and data is compromised.

> Besides an initial capital outlay to provision select conference rooms with ISDN connectivity, there are few additional costs required to begin videoconferencing using ISDN. A standard ISDN business-level videoconferencing call at 384 Kbps requires the bonding together of 6 ISDN channels; higher call speeds require

> the bonding of additional channels. Enterprises pay for ISDN on a per-minute-per-B-channel basis (often based on distance as well), making the use of the equipment costly. TV quality video at 768 Kbps on an ISDN system quickly becomes prohibitive in cost. These expensive ISDN usage fees often prohibit deep adoption of ISDN videoconferencing within an organization or enterprise (Jang et al., 2003, p. 2).

ISDN can lead to other technical problems such as routing issues, cable problems, configuration issues, or even protocol issues (Intel, 2005).

There is another standard that is used in videoconferencing. This standard is IP (Internet Protocol) which

> Specifies the format of packets, also called *datagrams,* and the addressing scheme. Most networks combine IP with a higher-level protocol called *Transmission Control Protocol (TCP)*, which establishes a virtual connection between a destination and a source. IP by itself is something like the postal system. It allows you to address a package and drop it in the system, but there's no direct link between you and the recipient. TCP/IP, on the other hand, establishes a connection between two hosts so that they can send messages back and forth for a period of time (Webopedia, n.d. ¶1).

Using IP has several advantages over using ISDN as a standard, which may help alleviate some of the technical difficulties that arise. IP relies on the Internet rather then telephone-based technologies (Regenold, 2001). Using IP can provide increased convenience for a user, the addition of audio and video, ease of integration of collaboration tools (e.g., PowerPoint presentations), and the ability to manage communication technology on a single network. It is more ubiquitous in nature, and has fewer accessibility issues (Garay, 2001). "Today, you can start an IP videoconference anywhere and at anytime—from your desktop, from a room down the hall, or from any room on campus where there is a decent network connection" (¶ 8).

A business case exists to use IP videoconferencing instead of ISDN for purposes of collaboration (Davis and Weinstein, 2002). IP videoconferencing has the potential to reduce travel times, increase productivity, provide a visual contact with other participants, allow simultaneous interaction and collaboration, and to provide a precise tool for communication, recordable meetings, and document sharing capabilities (p. 8). The choice between ISDN and IP comes down to fiscal constraints, the quality of audio and video feed required, management, efficiency and level of reliability required, and scalability (Jang, Kelly, and Davis, January 2003). No matter what standard is used, careful consideration needs to go into ensuring that all potential technical components are in working order before a videoconference is to begin.

Besides the standard that is used, the codec that is chosen can also become a challenge when a user attempts to initiate a videoconference. "Videoconferencing hardware uses a codec to code the outgoing video and audio signals and decode the incoming signals. Prior to transmission, the codec converts analog signals to digital signals and compresses the digital signals. Incoming audio and video must be decompressed and converted from digital back to analog" (SBC Knowledge Ventures, 2004). The purpose of having a codec is the size reduction of digital audio samples as well as video frames in an effort to accelerate transmissions and to save storage space (Answers.com, 2005).

There are several types of codecs used in videoconferencing systems such as H.261, H.263, H.264, H.320 and H.323. H. 2xx is recommended for video transmissions, H.320 is recommend for ISDN and H.323 is recommended for IP

(University of Cambridge, 2004). Of these four, H. 261 is the most commonly used as it works with the three most common television formats known around the world (i.e., NTSC, PAL and SECAM) (ViDe, 2005). H.261 is the real-time transport protocol used in the H.323 standard.

H.323 has the ability to transmit video over networks and is used at the University of Alberta's Cyberport. H.323 is

> An International Telecommunications Union (ITU) standard that provides specification for computers, equipment, and services for multimedia communication over networks that do not provide a guaranteed quality of service. H.323 computers and equipment can carry real-time video, audio, and data, or any combination of these elements. This standard is based on the Internet Engineering Task Force (IETF) Real-Time Protocol (RTP) and Real-Time Control Protocol (RTCP), with additional protocols for call signaling, and data and audiovisual communications (Microsoft, 2005).

Just as it is important to ensure that the codec standard is agreed upon by videoconference attendees, it is also important when having a videoconference meeting to ensure the codecs are in working order. Despite all of the challenges that can arise within a videoconference environment, there are also benefits that can out-weigh the challenges.

Videoconferencing can provide visual cues, provide a forum for shared problems and experiences, provide an opportunity for higher productivity, and can possess educational value (Boutte and Jones, 1996; Brady, 2001; Crawford, Sharpe, Chun, Gopinathan, Ngoh & Wong, 2002). Under certain conditions, videoconferencing can stimulate interest, motivation and imagination; connect learners and colleagues from various geographical areas; provide forum in which to share different perspectives; promote media awareness and visual literacy; and

improve communication, presentation, research, creativity, and management-type skills (Finn, 1997; Safari Technologies, 2004).

Some studies have made the case that this medium has no effect on learning or on a learner's experience (Clark, 1993; 1994; Knipe and Lee, 2002; Kozma, 1994; Veen, Lam and Taconis, 1998). There are other studies that state otherwise. For example, in a study by Jones and Sorenson (2001), dubbed the Mercury Project, videoconferencing was used to link learners from the University of Tennessee to learners located in France (Universite d'Orleans) learning the French language. The intent of this study was to provide a new and varied approach to language instruction. The authors concluded that the learners benefited from this videoconference experience: "the videoconference occurred in real time and views were expressed extemporaneously. Were it not for the face-to-face opportunity provided by the videoconference, this kind of authentic exchange would not have been possible" (p. 7).

Daly-Jones, Monk and Watts (1998) argued that little evidence exists within current literature to support the claim that significant advantages exist when using videoconferencing over other mediated communications (e.g., audioconferencing). To demonstrate that advantages exist, Daly-Jones et al. conducted two experiments within the same study. The first experiment focused on dyadic interaction amongst participants while the second experiment focused on small groups. The participant's conversational fluency and interpersonal awareness within different modes of communication (i.e., videoconferencing and audioconferencing) were analyzed through the observation of a video recording of

their interactions. Daly-Jones et al. made several conclusions. The conclusion most relevant to this study was that "there was evidence that video resulted in more fluency of communication then audio alone" (p. 52). If there are advantages in using videoconferencing over other mediated communications, then an argument can be made for its use to educational researchers as a medium.

Olson, Olson and Meader (1997) reported on two studies that focused on gathering data under four different conditions: face-to-face with a whiteboard, paper and pencil; face-to-face with a shared editor; remotely with an editor plus high-quality spatial audio; and remotely with the editor plus audio and high-quality video (p. 157). The two studies sought to assess three things: the quality of the product, the participant's satisfaction with the process, and the process of design and coordination (p. 162). They concluded that, "work with remote high-quality video to support conversation is as good as face-to-face. Remote work without video is not as good as face-to-face" and "when there is no video connection, the participants reported in the questionnaire that the quality of the discussion was significantly poorer" (p. 165-166). Important to note in their study was that "the perceptions of the users…is that video clearly adds value…remote work can be done without the loss of quality" (p. 170). These findings have great significance to educational researchers wanting to collaborate remotely via videoconference as it is likely that there will be no loss in the quality of discussion, work or objectives of the group.

The ways one uses videoconferencing, or the approach in which one uses videoconferencing, "depends on your communications goals, how constant or

changeable they are, the number of people and places involved, how often and how far…whether people need to see each other or merely hear…and how much money is available" (Hilton and Jacobi, 1986, p. 12). It is important that the goals are explicit to all users when deciding on whether to use videoconferencing as a mode of communication or what type of videoconference system to use.

Real-time Videoconference Collaboration

Real-time Collaboration

There are different models of collaboration. Butler and Coleman (2003) outlined five different categories of collaborative environments including Library, Solicitation, Team, Community, and Process Support. The category of Library, or "Repository", is largely characterized by reciprocal access to common content or data. Solicitation is largely characterized by requests by a small number of requestors for responses by many respondents. In an educational context, solicitor collaboration would occur when a conference calls for proposals, a call to which many researchers would respond.

Butler and Coleman (2003) stated that team collaboration is used to facilitate the activities of a team where there are common objectives, a shared stake in success, parameters, interdependent members, entry requirements, and a small list of members. An example of team collaboration within education would be researchers working on a project together. Community collaboration is less common but an extremely powerful model. Butler and Coleman (2003) identify the characteristics of this model:

- members have common interest, affinity, or goal,
- members of the community are often self-grouping,
- members seek to share information,
- members seek to further their understanding of the practice or area of interest,
- membership is loosely controlled,
- membership must be relatively large to be self-sustaining (new content is always needed),
- large communities are often moderated, facilitated or edited,
- all members are encouraged to both read and write content,
- most members find value in just reading,
- contributors are usually around 10% of the community population,
- most of the interactions are asynchronous, but over the last few years "chat" communities have sprung up that utilize IM as the interaction media instead of threaded discussions,
- rules of engagement, or appropriate behaviors for the community are often well defined (¶ 12).

The last model of collaboration that Butler and Coleman (2003) detailed was Process Support which is characterized by the use of collaborative technologies in a particular process or workflow. These authors concluded that the power of these models is derived through their amalgamation. "For example, by combining the Library and Solicitation models an association can create a "best practices" library by soliciting feedback on each practice; as a result, those using the practices can make them that much more valuable (to others)" (¶ 20).

A key component of quality collaboration is effective communication between participants. "Good communication leads to good collaborative thinking and sharing among students. Such collaboration leads to the formation of learning communities, instead of isolated instances of learning" (O'Conner, 2003, ¶3). Other components include

- early involvement and the availability of resources to effectively collaborate,

- a culture that encourages teamwork, cooperation and collaboration,
- effective teamwork and team member cooperation,
- defined team member responsibilities based on collaboration,
- a defined product development process based on early sharing of information and collaboration,
- collocation or virtual collocation, and
- collaboration technology (Crow, 2002, ¶ 2).

There are various methods of communication, and thus different ways in which researchers can collaborate within a virtual environment (Wainfan & Davis, 2004). Jonassen, Howland, Moore, and Marra (2003) stated that videoconferencing can support meaningful learning by forming discourse communities and supporting communities of practice. "Videoconferencing best supports meaningful learning by helping diverse learners [and/or researchers] to collaborate and converse with each other in order to solve problems and construct meaning" (p. 158).

One requirement that supports real-time collaboration is multimedia communication tools, "because the traditional data exchange between workstations needs to be enhanced with audio to allow conversation among the participants for effective human interaction" (Aldred and Bonsall, 1995, p. 519). Without these multimedia communication tools, real-time collaboration would not occur.

The Bridges Consortium II was hosted by the Banff Centre. This consortium provided an opportunity for cross-disciplinary exchanges between seventy-five artists, twenty-one scientists, seventeen social scientists and humanists, and seven institutional representatives from Africa, Latin America, Europe, the United Kingdom, the United States of America, Australia, and

Canada (Diamond, 2002). "The Banff Symposium show-cased research collaborations in new media with strong emphasis on cultural difference, aesthetic and human issues in technology development, as well as new methods for artists, scientists, technologists, institutions and other creators to collaborate" (p. 2). One of the conclusions of the consortium relevant to this study was that the great challenge of convergence is not technology, but communication between people. "Collaboration itself is a skill to be studied, learned and politicized" (p. 13).

Challenges and Benefits of Videoconference Collaboration

Wainfan and Davis (2004) wrote a book on challenges facing modes of virtual collaboration such as videoconferencing. They summarized literature on face-to-face collaboration and videoconference collaboration and mapped the framework of contextual variables, group process, and outcomes. For contextual effects, they found that videoconferencing collaboration increased workload for participants because members shifted to simpler problem-solving strategies and limited the opportunities to raise counter-arguments.

For process effects, they found that conversation within videoconference collaboration was more orderly and polite, there was more equal participation and influence, but with an overall lower persuasiveness among individual participants. For outcome effects, the findings within videoconference collaborations, was that local coalitions formed which were biased toward those in the room. Furthermore, there seemed to be lower confidence in decision-making, less satisfaction with the overall process, more communication break-downs, lower rapport and

videoconference was preferred if the collaboration was intended for mildly competitive discussion (Wainfan and Davis, 2004).

Another challenge of collaborating via videoconference is transmission delays (Ruhleder and Jordan, 2001). Transmission delays can lead to disrupted turn-taking which can mean the participants are less likely to engage in complex, subtle or hard-to-manage interactions (Tang and Issacs, 1993 as cited in Ruhleder and Jordon, 2001). Ruhleder and Jordon created hypothetical experiences for adjacency pairs with delays in video transmission to analyze conversation and its effect on their overall experience. "Adjacency pairs consist of two turns in which the second pair part is contingent on the first. Some commonly occurring pair types are greeting-greeting (farewell-farewell), question-answer, and offer-accept/decline" (p. 119).

Ruhleder and Jordon (2001) found that as people become more familiar with these types of technologies and technical problems often associated with them, they generally will adapt. However, they argued that people will have to reinterpret the context and meaning of a conversation when a delay is only apparent to one user. They conclude that if collaboration is required, then it is important to assess whether video-mediated technologies and the transmission delays that may occur would ultimately hinder the endeavour. "While quick give-and-takes, brainstorming, and trouble-shooting sessions are probably highly vulnerable to this kind of trouble, interactions with explicitly laid-out rules for turn taking, such as structured events and formal meetings, are less likely to suffer from the kinds of trouble illustrated above" (p. 133). Therefore, the ways in which

technology is utilized within a collaborative videoconference environment can contribute to its effectiveness or ineffectiveness.

Kanuka (2001) carried out a study which used participants from a Bachelor of Education program in Adult Education at a post-secondary institution in Canada. The program was delivered by distance education for rural learners in remote areas of Alberta using a multi-point delivery videoconference system incorporating computer-mediated audio and video feeds. It was piloted with thirty-seven participants. The findings were that participants "perceived the integration of the Web to be useful as a content delivery platform and a study guide," but demonstrated frustration due to insufficient course organization and structure, lack of timely and informative feedback, and vague or confusing instructions (p. 66).

Wainfan and Davis (2004) surmised that all media can change the context of communication by regulating conversation, indicating participants' perspective, power and status, and moving the group towards agreement. In the case of videoconference collaboration, "local coalitions can form in which participants tend to agree more with those in the same room than with those on the other end of the line" (p. xiv). Lurey and Raisinghani (2001) noted that for videoconference collaboration to be successful, its members must "create dependable processes and strong interpersonal relationships if they are to achieve their objectives" (p. 533).

Videoconferencing is versatile in nature and can provide opportunities for collaboration within a wide range of fields of research, development, and

learning. For example, a videoconferencing system was used to deliver small-group, practice-based learning to thirty-one physicians situated within three different small communities (Allen, Sargeant, Mann, Fleming & Premi, 2003). The participating physicians had limited access to learning resources and other medical professionals to collaborate with and learn new practices from, so teaching new medical techniques through videoconferencing was a viable solution to this challenge. Allen et al. concluded that videoconferencing was an acceptable means by which physicians and facilitators could communicate and learn (p. 46).

Isaacs and Tang (1997) stated that video could support and enhance collaboration as there is no one method of utilizing video--it is dependent on the tasks and settings. They argued that video can enhance a user's experience, can assist people to interpret subtle visual cues that accompany interactions, enable distributed conversations that would not have happened otherwise, generate awareness, provide identity and recognition, and create a focus (pp. 190-192). They sought to support this theory through the creation of three video-based prototypes that were tested by various individuals with small workgroups and large organizations using basic desktop videoconferencing by asking if video can be usefully integrated into people's work practice. The results of their study confirmed that, "users like video, but [it] also uncovered concrete information about the value of video supporting interaction" (p. 195).

Effectiveness of Videoconference Collaboration

After identifying benefits and challenges of collaborating within a videoconference environment it is important to ask whether or not it is effective.

"Video-mediated communication (VMC) has been touted as an invaluable tool for such applications as remote collaboration, conferencing, and distance learning. In many cases its desirability is taken for granted, much as was the case of color for computer monitors" (Finn, 1997, p. 3). Videoconference collaboration can be problematic for educational researchers as issues often arise. Such issues include the challenge of encouraging the distribution of thinking within a group in real-time, simultaneous work on the same aspect of a problem in real-time, the sharing cognitive responsibility for the task or goal of the group in real-time, and the encouragement of thinking together in real-time (Palincsar and Herrenkohl, 2002). Challenge though does not necessarily equate with effectiveness.

Within the field of education, the educational paradigm is transforming from a competitive model to a more collaborative model (Hardwick, 2000). This collaborative model has led to a more student-centred approach thus touching upon more learning styles (Smith, 1985; Bruffee, 1987; Slavin, 1987 as cited in Hardwick, 2000). This same collaborative approach can be applied to educational researchers, who also have varied and transforming learning and working styles. If learning and working styles are explicitly addressed, then some of the challenges can be addressed.

Collaborators' self-confidence, computer literacy skills, mutual trust within the group of participants, communication, research skills, group outcomes, individual knowledge and access to it, social skills, and motivation in relation to certain approaches can all contribute to the effectiveness of a videoconference

collaboration (Johnson, Kai Yung Tam, Lamontagne, and Johnson, 2003; Katz and Rezaei, 1999; Schweizer, Paechter, & Weidenmann, 2003).

When collaborating within a videoconference environment, it would be advantageous to address these areas as well as provide additional time and resources to the attendees, provide a positive view of collaboration, discuss or disseminate positive outcomes of previous collaborations that worked effectively, implement rewards and consequences for participants in the collaborative efforts; engage in serious pre-planning by forming a steering committee, and/or clearly articulate the developing goals (Johnson, Kai Yung Tam, Lamontagne, and Johnson, 2003; Katz and Rezaei, 1999; Schweizer, Paechter, & Weidenmann, 2003). These approaches to any collaborative effort, regardless of the medium in which it is done, can be applied for improved results.

Lurey and Raisinghani (2001) examined the effectiveness of collaboration within virtual teams by conducting a survey of sixty-seven participants. They concluded that their collaboration was successful in that it addressed the "issue of effectiveness within these virtual teams but also [determined] a number of critical success factors for them" (p. 532). Lurey and Raisinghani stated that issues that effect virtual teams can also affect co-located teams. Virtual teams must learn to communicate just like co-located teams would. Virtual team leaders should, "establish positive team processes, develop supportive team member relations, create team-based reward systems, and select only those team members who are qualified to do the work" (p. 532).

Schweizer, Paechter, & Weidenmann (2003) conducted an empirical study to examine learning that occurred within collaborative groups (n=96) within blended as well as e-learning environments. Schweizer et al. concluded that achievement in the learners in all of these courses did not solely depend on the communication setting (e.g., videoconference). However, if the learners had to share and exchange knowledge in an effort to achieve a joint solution, then the higher achievers were found within the learners within the synchronous courses, especially when videoconferencing was used. "Videoconferences also enable a 'rich' communication…because they allow immediate feedback, a multiplicity of cues, greater personalisation, and a greater language variety" (p. 221).

Summary

This chapter reviewed literature pertaining to videoconferencing as well as videoconferencing collaboration. Videoconferencing began with the creation of AT&T Picturephone test system in 1954 and its testing at the World's Fair in New York (Park, n.d.; Roberts, 2004) and has since grown to be a commonly used mediated mode of communication within education. There are two main types of videoconference systems including desktop videoconference systems (DVC) and integrated videoconference systems (IVC).

With either system, there are both benefits and challenges to videoconferencing. It was important to outline both the benefits and challenges to provide a balanced view of the medium as well as to assess whether it is an effective medium for particular purposes. Benefits of videoconferencing can include seeing visual cues of attendees, reduction in traveling time and costs,

visual cues, shared problems and experiences, higher productivity, and educational value. Challenges that one can encounter when videoconferencing can include technical difficulties leading to lost time, overcoming participant anxiety or empathy towards videoconferencing, purchasing and maintenance costs, perceived need of high technical skills and know-how, or lack of interaction.

CHAPTER THREE: RESEARCH METHODOLOGY

Introduction

This chapter will discuss data collection methods, the particulars of participant selection, ethical considerations, and data analysis techniques used in this study. There were four phases of this study. The first phase was narrowing down my research interests. The second phase was collaborating with an expert to develop a set of criteria for selecting participants and assembling a list of potential participants that were known experts within the fields of educational research and videoconference collaboration. The third phase was contacting the potential participants and conducting the interviews with those who consented. The fourth phase of this study involved the transcription, coding and analysis of the interviews for presentation purposes.

Data Collection Methods

I chose qualitative interviews as the method by which to collect data (Johnson and Christensen, 2000). "Qualitative interviewing allows a researcher to enter into the inner world of another person and to gain an understanding of that person's perspective" (Patton, 1987, as cited in Johnson and Christensen, 2000, p. 144). I also followed an interview guide, meaning that I planned to explore specific topics by asking open-ended interview questions with the participants (Johnson and Christensen, 2000). A benefit of using the interview guide approach was the ability to change the wording of the questions and elaborate on questions as necessary through the interview process (ibid.). I emailed a list of thirteen

semi-structured questions and one open-ended question (Appendix A) to every consenting participant before the interview to allow them to reflect and compose answers.

Each question was related in some way to this study's research objective and/or this study's three research questions. Questions One and Two asked the participants to define real-time collaboration and videoconferencing. Question Three asked how much value they placed on collaboration while Questions Four and Five sought to determine their respective thoughts on the strengths and weaknesses/impediments of collaborating within a videoconference environment. Question Six asked if the participants would collaborate using videoconferencing in the future while Question Seven asked if they thought information was effectively disseminated using this medium. Question Eight asked each participant to theorize on ways in which to improve collaboration within a videoconference environment. Question Nine asked how often they used videoconferencing to collaborate within the work they did and Question Ten sought to ascertain what each participant thought was the most misunderstood concept about real-time collaboration within a videoconference environment. Question Eleven asked the participants to describe their ideal videoconference/collaboration system and Question Twelve asked if videoconference changed the way in which the participants collaborated with their peers. Question Thirteen asked about their ideal method of collaboration and Question Fourteen was an open-ended question for additional thoughts, feelings, or experiences the participants wished to express.

The interviews were recorded on a tape recorder and later transcribed. As mentioned within delimitations (Chapter One), a variation of non-probability or purposive sampling, called expert sampling was used (Johnson & Christensen, 2000; Trochim, 2002). Expert sampling allows the researcher to choose participants who are known experts in a field. The limitation of expert sampling (i.e., the ability to generalize data findings to a larger population) was reduced by creating four criteria for selecting potential participants. The four criteria required that participants have experience as educational researchers at either a post-secondary institution or research organization, possess a high level of experience within videoconference environments, demonstrate a high-level of understanding of videoconference technologies, and able to identify "best practices" of effective collaboration within a videoconference environment.

Certain assumptions can be held by the researcher when conducting interviews (Partington, 2001). "At the commencement of the interview, the interviewer and the interviewee do not share an understanding of the phenomena under investigation and the interviewer's comprehension of, and attitude towards, the phenomena are possibly very different from those of the interviewee" (¶ 8). My comprehension of and attitudes towards videoconference collaboration were secondary to that of the participants interviewed.

One assumption can be that the participants have information that the interviewer requires (Partington, 2001). For this study, my assumption was that the participants would be able to answer each question with relative certainty and clarity based upon their experiences and expertise. I retrieved and recorded the

experiences, thoughts and general feelings of the participants towards collaborating within a videoconference environment.

Another assumption can be that rapport naturally exists between the researcher and the participants (Partington, 2001). "The quality of data obtained can vary considerably depending upon the skill of the interviewer in establishing rapport, following up leads and demonstrating attention and interest" (¶ 25). Rapport must therefore be built between the interviewer and the participant in order for the information that is sought to be disclosed. In this study, there was an effort in both face-to-face and telephone interviews to engage in personal conversation before and after the interview as a rapport-building mechanism. "Effective interviewing is a complex task requiring attendance to a range of skills and information all at the one time" (ibid).

Partington (2001) noted that, "despite training in the techniques of interviewing, the data that are obtained might be corrupted by inappropriate questioning, inadequate listening or the absence of desirable interpersonal skills on the part of the interviewer" (¶ 1). In order to avoid corruption of data, each participant was asked the questions using identical wording. As previously mentioned, each participant was also sent the questions ahead of time for review. Some of the participants expressed appreciation for having the questions ahead of time, while others were unable to review the questions due to other commitments.

All participants (n=17) of this study were advised that the interview would be approximately ten to fifteen minutes in length. One participant emailed the responses to the interview questions back to me instead of conducting a telephone

or face-to-face interview, five participants opted for a face-to-face interview while the remaining eleven participants were questioned in a telephone interviews.

Sources of error can arise when conducting an interview (Weiss, 1998 as cited in Wiersma, 2000). One such error is the predisposition of a participant to respond in a specific manner, referred to as a response effect. To the best of my knowledge, the response effect did not occur. Each participant was advised that the identity of each participant would remain anonymous. Based on this, there seemed to be little reason for the participants to feel unmotivated, threatened or cautious in their responses.

Participant Selection

Of the forty-six participants contacted, seventeen participated in the study - a 37% participation rate. Fourteen males and three females participated in this study. Each participant was an adult, Canadian citizen with a minimum of one university degree. One participant resided outside of the province of Alberta, while the other sixteen participants resided within Alberta. All seventeen participants had collaborated using videoconferencing within the field of educational research, thus meeting the criteria previously established.

Thorough research and planning went into structuring and wording the interview questions as well as the interview process. I also practiced the interview process with non-participants to increase my interviewing skills. A microphone and a tape recorder were used for both the face-to-face and the telephone interviews.

Ethical Considerations

All participants were volunteers and participated in this study by their own free will. A consent letter approved by the University of Alberta was sent to each participant to review, sign and return before the commencement of the interview (Appendix C). In addition to the consent letter, a verbal consent was prompted from each participant at the beginning of the recorded interview. A University of Alberta ethics review application was completed and approval for the commencement of the interviews. The interviewing began in June 2004 and was completed by July 2004.

All of the interviews were transcribed. Confidentiality was promised to each participant. By doing so, it was believed that each participant would have the opportunity and comfort to express true feelings and experiences of their collaborative experiences within a videoconference environment. Furthermore, many of the participants were known within the field of education so the fact that comments remained confidential would further ensure the opportunity to express their thoughts openly.

Data Analysis Techniques

After the interviews were transcribed, I created a nested list in which the participants were given a code number (e.g., Participant 4) and positioned into columns. Each question then became a row. Answers to each question were put into the table in order for quick analysis and calculation. This process was time-consuming as there were over 221 answers to transcribe (13 set questions per interview * 17 participants + any open ended questions).

Summary

This chapter discussed the data collection methods, the particulars of participant selection, ethical considerations, and data analysis techniques used in this study. There were various stages of this study. Seventeen participants, known experts within the fields of educational research and videoconference collaboration, agreed to participate in this study. Ethical considerations were addressed and all of the interviews transcribed and coded for presentation.

CHAPTER FOUR: DATA PRESENTATION AND ANALYSIS

Introduction

Sample of seventeen expert participants was carried out between June and July of 2004. Each participant was an expert within the fields of educational research and videoconference collaboration. A carefully-constructed interview guide approach was used with each participant, meaning that the questions were made known to the participants ahead of time (Appendix A) (Johnson and Christensen, 2000). I was also able to adjust the wording of the questions and elaborate on a particular point with a participant if the need or opportunity arose (ibid.).

The data have been arranged in this chapter in the order in which the questions were asked. As a means of organizing the large amounts of qualitative data obtained in this study, every question is separated and its corresponding data provided. The implications of the data presented in this chapter will be discussed in Chapter Five.

Question One: In your own words, how would you define real-time collaboration?

The purpose behind Question One was to determine the view of each participant towards this term before the remaining questions were asked in order to illustrate the context from which they were deriving their answers. Fourteen participants defined real-time collaboration as the involvement of more then one person working towards a common goal or outcome: "Two or more people

sharing ideas, coming up with ideas, and engaged in an exchange of information in which everyone involved is learning and growing" (Participant 11).

Answers varied with the remaining three participants. Participant 4 defined real-time collaboration as:

> A very natural part of the creative process. I look at it from that point of view, and it's something that, well, it's becoming more and more of a necessity in terms of the...new technological paradigm in which we work, and therefore it's something that, although may come naturally to some individuals, has certainly come naturally in certain kinds of forms of expression research, it does not come as naturally to others, and therefore, I think has to be sort of treated as a separate field of study in order to encourage its presence.

Participants 1 and 11 respectively focused more on the "real-time" component of real-time collaboration: "we're all on the same time regardless of the time zones, and it's happening in the now;" and "in the same sort of time frame, I could talk to you over distance...at one location, and you could be at the other location."

Question Two: In your own words, how would you define videoconferencing?

The purpose of this question was similar to Question One — determining how each participant defined a specific term relevant to this study. In this particular case, the term was videoconferencing. Eight of the seventeen participants noted that videoconferencing minimally involves an exchange of both audio and video between two locations. "Videoconferencing is certainly the exchange of video and audio data over some type of connecting medium between two remote sites, or more then two" (Participant 6). Participant 2's definition was

similar in that there is "the use of video and audio at a distance…to be able to communicate with one or more groups in real-time."

Of the remaining nine participants, the definitions of videoconferencing ranged from abstract definitions to more concrete definitions outside the scope of the other eight. Typical responses of these nine participants were those of Participants 4 and 13. Participant 4 defined videoconferencing "in terms of a kind of a spatial transposition. I look at is as a form of media, meaning that is has its own inherent attributes and creative possibilities…I look at it also as a means of expression," while Participant 13 remarked on the components and strengths of videoconferencing as part of the definition.

> Videoconferencing means to use video technology to communicate with another individual over distance. It usually involves both visual and audio components. It is strictly through the use of technology and computers or computer components. It allows individuals who wouldn't see each other, to see each other.

Participant 5 had a divergent definition of videoconferencing from the rest of the participants in that it is a *process*: "Look at videoconferencing as a process, a particular way of doing things…if you talk about it as an instructional technology, then you need to talk about the pedagogical implications and assumptions that go along with that."

Question Three: How much value, if any, do you place on collaboration?

The purpose of asking Question Three was to ascertain at the beginning of the interview if the participant placed any value on collaboration. The rationale for asking this question was that many of the participants were required to collaborate within a videoconference environment for their research, but that did

not necessitate that they perceived any value in or from it. Of the seventeen participants, ten participants placed 'high' or 'extreme' value on collaboration.

> I am a social constructivist so I think meaning gets made and knowledge gets developed or constructed in a collaborative environment, in a social situation, or in conversation, for example. It happens through negotiation and it happens through sharing experiences. It happens through a development and realignment of values…(Participant 5).

Participant 10 commented, "I happen to be a major collaborator. Almost every project I work on has anywhere from two to ten people working on the project. I value that immensely." Participant 15 also placed high value on collaboration:

> For me I am probably not typical…I place maybe too much value on it. For me…in the area of evaluation, the only way you can really move forward in it is if you develop some sort of collaborative relationship. If I, as an expert, come in and evaluate something, don't establish the communication I need, and I provide you with the work at the end of the day, the odds I think of it getting used are pretty remote because there is not anything…it's external and it's all one person's judgement on somebody else. I think that's a very difficult thing. It is much better if I collaborate with you, get your involvement, get you to participate in working on the questions, get you looking at the kinds of criterion we are using and getting involved in the process because then you have buy-in in something and some stake in the process…you benefit because you bring multiple perspectives to what you are doing.

Participant 7 noted how collaboration goes beyond the boundaries of any institution and is often needed to resolve problems.

> It's very difficult to…solve a lot of problems all by yourself, and the collaboration goes well beyond the boundaries of any institution…in the IT field we definitely have an interest of collaborating with our peers at other institutions in the sense that they're facing the same problems we're facing, and they have innovative and just interesting viewpoints that really helps solve our problems.

Participants 12 and 13 perceived little value in collaboration and collaborative research. For example, Participant 12 commented:

> Collaboration is a nice thing to have and meetings are great for organizing things, but I don't believe it is necessary in education. People can work without collaborating with each other. They can learn without collaborating with each other and for many, many people, they prefer not to collaborate, they would rather learn on their own. So, I am not sure we should be pushing collaboration in education as much as we do.

Participant 13 also commented:

> I have to say for me personally I don't place as much value on collaboration as I would estimate other individuals do. I find that often collaboration tends to hinder me. I don't believe that other people don't have things of value to contribute, but I do believe that often communication is ineffective - whether or not it is the medium or the individual...collaboration can really slow down a process.

The remaining five participants alluded to collaborating with colleagues due to work requirements or work-related tasks without adding comments on their perceived valuing of it. A typical answer from these five participants is illustrated by the comments of Participant 2. "Within our type of environment...and with the groups we work with externally...it is one of the key elements for us to be able to operate and function appropriately on a day to day basis."

Question Four: What do you see as the greatest strength(s) of collaborating in a videoconference environment?

The main purpose of asking Question Four was to answer one of the research questions of this study. In analyzing the data from this question, I could better assess whether or not videoconferencing had an effect on collaboration. If an effect became apparent, then the strengths of collaborating within a

videoconference environment would certainly be of interest to educational researchers already using or considering using this medium. Every participant had experience collaborating within a videoconference environment, so they were all able to provide their comments and opinions on this particular question.

I divided the results of this question into similarities in what was said and by how many participants due to the volume of data that was collected for this question. Of all seventeen participants, only one thought there was little merit or strength in collaborating within a videoconference environment. "I don't know, how can I put it…I don't see any strength of videoconferencing…but I do see many weaknesses" (Participant 12). The remaining sixteen participants perceived various types of strengths associated with videoconferencing. Participant 4 saw strengths in collaborating within a videoconference environment but changed the interview question to reflect that it is more about possibilities:

> I don't think about it in terms of…[strengths]. I just think about it in terms of…possibilities…We're a visual culture…therefore if you are starting to talk about linking a community, you can tell a story about a community much more if you can bring in an artefact, if you can bring an object…if you can show a film, if you can do that king of thing versus having a conversation where you get this kind of stilted…conversation.

Ten participants noted that the opportunity to see body language (non-verbal cues), from their colleagues was the greatest strength of collaborating via videoconference. A typical response was provided by Participant 7. "You get more cues about how people are thinking, and what they're really intending with their words…you can have the ability to see somebody" (Participant 7). Participant 13 commented, "The greatest strength of collaboration via

videoconference is obviously the ability to have face-to-face contact with individuals over distance, especially living in a kind of global community in both the academic and corporate world."

Seven participants perceived that collaborating via videoconference created a larger sense of community in that it eliminates distance barriers between themselves and fellow collaborators. For instance, Participant 8 commented, "it allows you to bring people together over distance without actually having to travel to that spot. You save a lot of money that way."

Four participants commented that collaborating in a videoconference environment provided the opportunity for data and artifact sharing between colleagues. Data sharing can be a common tool integrated in most videoconferencing systems. Data sharing can include chat rooms, whiteboards and email. For instance, Participant 15 stated, "you have the ability…to share things like…you can theoretically share documents online, you can share files, you can share other things."

> Three participants stated how communication is enhanced when collaborating within a videoconference as it makes the experience more humanizing. For instance, Participant 3 stated, "the greatest strength with videoconferencing would be to me…humanizing the communication that you have with others. So, I think that it personalizes the communication in a way that e-mail and phone calls really don't provide…the greatest strength is making that connection."

Participant 16 summarizes the point of humanizing well.

> It gets closer to a real, physical, face-to-face meeting. I don't think it replaces it, but it comes close depending on how well it is done. You can see the other person, you can see what they look like, and I think that does something for most human's brains…creates a greater level of intimacy and meeting or conversation. It makes it

> more personable. You can see body language. It is more intimate experience depending upon how well it is done.

The remaining comments regarding the strengths of collaborating within a videoconference environment were summarized by two participants. These strengths included: the potential for new possibilities, elimination of travel, an increase social presence, an outlet for creative expression, cost effective, audio and video connections, increased accessibility, and the allowance for synchronous communication. For instance, Participant 17 stated that there are "...lots of strengths, actually. Reduced travel time…reduced cost…simultaneous audio and video connection."

Question Five: What is the greatest weakness/impediment to collaborating within a videoconference environment?

Question Five is one of the research questions posed for this study. This question provided an opportunity to obtain a more complete view of the participant's experiences and thoughts towards collaborating within a videoconference environment as well as produced a large number of responses. Table 1 summarizes these responses.

Table 1: Frequency of Expressed Weaknesses/Impediments by Participants (n=17) Towards Collaborating within a Videoconference Environment

Expressed Weaknesses/Impediments	Number of Times Expressed by Participants (n=17)
Technical problems	16
Audio and video latency issues	*6*
Network related issues	*4*
Difficulties data sharing	*2*
Lack of visual detail	*4*
Costs (inherent, maintenance, etc.)	4
Needs preparation	3
Not ubiquitous	3
Requires a technician or technical expertise	3
Technical inexperience of participants	2
Misalignment of cameras	2
Requires experienced person at remote location	2
Skewed preconceptions of attendees	2
Technophobia	2
Not used appropriately or to its full potential	2
Accessibility issues	1
Background noise	1
Feelings of frustration	1
Unnatural feeling	1
Having to relocate	1
Imposes a formal process	1
Lack of "chit chat" / networking opportunities	1
Lack of etiquette	1
Lack of shared standards	1
No physical contact	1
Not a full picture of what is actually going on	1
Poor quality equipment	1
Learning styles are at odds	1

The most common response by participants towards the weakness of collaborating within a videoconference environment was experiencing technical difficulties. Participants often listed several types of technical problems such as video and audio latency issues, difficulty in data sharing, network issues and lack of visual detail.

> I don't think I've ever been to any videoconference session where there hasn't been a technical problem…where a good chunk of the time is spent around the technical issues…I sit there and think, 'well, why did I even bother'? We should just pick up the phone…the technical piece just annoys me sometimes (Participant 7).

Participant 13 stated that "the greatest weakness to collaborating within a videoconference environment…are the technical issues."

Participant 14 provided more detail. "Videoconferencing inherently has transmission constraints, image or audio delay, difficulty sharing documents, and imposes a formal process on the interactivity of a session, or its participants." Participant 4 commented on the actual technology itself: "The big impediment is that, to me, the camera for a lot of people is still very intimidating, and as a metaphor the camera is almost always seen as something that is intrusive."

The next major expressed weakness by four participants was the cost associated with purchasing, installing and maintaining a videoconference system. Videoconferencing "does have those inherent costs" (Participant 9). Participant 17 clarified that costs will be different depending on the type of videoconference system and standard that is used. "Cost can still be an issue if…you're using ISDN lines as opposed to either, you know, NETERA[1] or IP-based videoconferencing…cost can be a barrier."

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[1] NETERA Alliance (http://www.netera.ca/home.html) manages and coordinates inter-institutional ICT research infrastructure (NeteraNet); resources connected to WestGrid, collaboration facilities, and stakeholders symposia.

Another expressed weakness was the lack of technical expertise among other participants. For instance, Participant 8 saw the greatest weakness as:

> People's lack of knowledge. A couple of years ago I would have said it would be technology, but the technology is pretty solid now…you don't run into a whole lot of technical problems as long as you do your due diligence beforehand to do the test connections and make sure everything is running smoothly, and then you don't have any surprises in the end, and that's the experience thing.

Having a limited amount of technical knowledge, skills or even access to equipment to properly participate in or organize a videoconference meeting could disadvantage or even frustrate some participants. "The average person won't walk into a videoconferencing suite and be able to get things up and running somewhere. So, it has a great demand for technical expertise, for documentation and all of that kind of stuff. Unfortunately, the technology evolves at quite a rapid pace so all of those things have to be maintained, people have to be re-trained…." (Participant 13). This line of thinking could be why three participants expressed the notion that the physical presence of a technician throughout the duration of a collaborative videoconference meeting was required, and thus an impediment to collaborating using this medium. Having a technician present for each videoconference collaborative session could formalize the process of collaboration thereby causing an escalation in costs and requiring extensive scheduling. "It almost requires having a dedicated technology person there and that's an expensive thing to do" (Participant 15).

Lack of accessibility was another expressed impediment to collaborating within a videoconference environment. Participant 5 for instance, talked about accessibility of the technology to diverse user groups.

> I believe there is a high accessibility issue and we don't really address it enough, or we address it from the point of, "ok, can you get to a videoconferencing site?"...but there are other issues involved with that as well. For instance, people [can be] disadvantaged by physical presence, just like they are in a face-to-face setting. People, for example, with physical disabilities...people that have a lot of trouble finding space in which to talk...people that find themselves dominated by the conversation of others...people that need more time to reflect, for example, on what is happening in the conversation and through videoconferencing there is even more of a 'hurry-up' kind of thing...In terms of accessibility, access to the technology...in terms of broadband...people...who don't have a lot of discretionary income...can't get high speed connections...or they get hand-me down computers that can't handle the technology that they need to have. One of the disadvantages because is real-time is geographical and time...temporal kinds of difficulties.

One perceived weakness that was brought out by participant 17 was lack of shared standards.

> There needs to become some consistency between the way things are done in the different institutions and...between the collaborators, because it seems to me that...if I've got my PC and I want to collaborate with somebody who's...out there on a Mac environment, we have a whole bunch of new technological hurdles, and I don't understand their issues, and they don't understand my issues, and so providing good open standards is going to be, again, key to...moving forward in collaboration. And not to say that everybody needs to use, you know, Windows machines, or everybody needs to use whatever piece of technology, but the idea is the open interoperable standards are going to be absolutely essential...for use to move forward, and quite frankly, I'm not sure I'm seeing that too much in...the collaborative environments...the videoconferencing...there still seems to be a lot of competing standards out there, and I don't know what will drive us towards one...consistent approach...that everyone can use" (Participant 7).

One participant expressed the notion that collaborating within a videoconference environment could inhibit or constrain certain learning styles.

> I have come across people whose learning styles are at odds with the mechanisms they are asked to use for learning. Visual learners

> are most appreciative of computer-based learning and adapt quite well to a videoconference session. Auditory learners enjoy videoconferencing because of the verbal nature of most exchanges. Anyone with a tactile bias to their learning style is going to be further encumbered by any system requiring them to sit still and talk (Participant 14).

Question Six: Would you collaborate using videoconferencing again?

After commenting upon the strengths and weaknesses/impediments of collaborating within a videoconference, participants were asked if they would collaborate using this medium again. The purpose of this question was to ascertain whether or not any of the participants would continue collaborating using videoconferencing in the future.

All seventeen participants answered Question Six. Fifteen participants explicitly stated they would collaborate using videoconferencing again. For instance, Participant 3 stated, "I think the advantages far outweigh the disadvantages and I think the equipment and our understanding of the technology gets better and better. These are all things that would lead me to using it again." Similarly, Participant 14 commented, "If it were necessary to share ideas and images with people over a distance – and for this to be in real-time – then videoconferencing is a viable option."

Two participants did not explicitly state that they would collaborate within a videoconferencing environment again, but did allude to using it in work they do. For instance, Participant 10 stated, "I've probably done over one hundred video conferences, the number goes way higher then that…I use it all the time."

Question Seven: Was knowledge and/or information effectively disseminated to the other participants within the videoconference environment?

The purpose of Question Seven was to answer one of the research questions of this study. Of the seventeen participants, twelve participants directly answered "yes" to the notion that knowledge/information was effectively disseminated to the other participants within the videoconference environment. Participants 10 and 16 respectively elaborated by noting that information was disseminated, but under certain criteria.

> The answer would be yes...when the moderators are effective and you had specific rules in place for how to do it...everybody knows how to connect...everyone hopefully connects on time...everyone has an agenda...everyone has prior access to all the relevant documents, and everybody knows the process that we're going to use to communicate.

> I would say if the conferences run well and you aren't having technical difficulties and other kinds of problems, then, yes. In fact, the majority of the conferences I have now, I would say that is the case. Depending on who you are connecting with, if they have a lot of experience with it and have people that are used to participating within a videoconference, then it pretty well goes seamlessly and I would say as good, and maybe even better, then a face-to-face meeting.

Four participants answered somewhat divergently from the previous group as typified by Participant 4. "I think there is a direct relationship between the comfort level with the medium and the ability to understand the medium and its attributes, and the effectiveness of the communication, and how the knowledge was moved from one point to another" (Participant 4). Participant 5 commented:

> You know, I have a little bit of a problem with the question, I guess. Knowledge being effectively disseminated...I have a different take on what knowledge is. Do I think that information was effectively *shared?* Yes.

There was only one participant who answered 'no' to whether information/knowledge was effectively disseminated using this medium: "No, I wouldn't say that at all" (Participant 12). Participant 12 did not elaborate upon this point.

Question Eight: Can you theorize on ways in which to improve collaboration within a videoconference environment?

The purpose of this question was to have each participant, or "expert", theorize possible improvements that could be make to collaboration within a videoconference environment so that a best practice list could be assembled. The results are illustrated in Table 2.

Table 2: Participant's Comments on How to Improve Collaboration within a Videoconference Environment

Improvements to Collaborating Within a Videoconference Environment	Number of Participants in Agreement
Provide participants with videoconference protocols/etiquette	6
Provide facilitation	4
Incorporate synchronous tools	3
Archive/record meetings	3
Make videoconferencing ubiquitous	3
Prepare materials/resources ahead of time	3
Provide a technician for meetings	3
Ensure appropriate set up and placement of equipment for optimum use	3
Install cameras with voice activation	2
Ensure high quality equipment is used– audio, video, lighting	2
Create awareness of technology and all of its capabilities with participants	2
Ensure similar videoconference systems between sites	1
Ensure that videoconference is being used appropriately	1
Advertise videoconferencing	1
Shut it off	1
Integrate immersive and engaging activities	1
Ensure the mobility of the videoconference system	1
Provide an alternative and continual mode of communication	1
Ensure a back-up plan	1
Have short meetings	1
Dual monitors	1
Close proximity	1
Ensure continuous communication before and after meeting	1

The most common comment was on the provision of videoconference protocols or etiquettes to participants. For instance, Participant 11 said:

> If I was leading a research collaboration and we were going to be using the medium of videoconferencing to do so, the first thing before we even started talking about our research, I probably…show them how we can properly engage, and make the session more meaningful before we even start talking about education, or computer science, or whatever…that would be the first thing I'd probably do….How do you engage a remote audience? How do we address each other? What type of etiquette

> are we going to use in our session? From there I think that would more positively influence our research collaboration no matter what the...sort of field would be.

The second most common response was having a facilitator or meeting coordinator that would keep participants on task: "[facilitate] a meeting so that [participants] work the same as they would in a standard, face-to-face application" (Participant 2).

Ubiquitous or transparent were terms that three participants used when generating ideas on how to improve collaboration in a videoconference environment.

> I think to me the...one thing I would like to see change or become better is that transparency to the user...so that the technology is just invisible in a sense. Just like when you pick up a phone, you dial a number. It is very painless, very simple, and very easy. It would be nice to feel the same way about videoconference systems where there is no technology to get in the way and worry about resetting the connection or checking various levels and testing it the night before (Participant 3).

Advertising was another way in which to improve collaboration within a videoconference as outlined by Participant 9. "Yes, getting greater buy-in from more and more people pushing this out of the expensive videoconference rooms to desktops and cameras on standard equipment in everyone's office. Maybe it needs a little bit of publication advertising, best practice identification. People need to know its being done and working."

The appropriate use of videoconference to collaborate was addressed by Participant 5.

> It needs to be used appropriately. So, it is not just a substitute for a face-to-face meeting. There are other sorts of affordances of the technology and the process itself that need to be really looked at.

> So, for instance, I would always ask… 'Why are you doing that? Is there a good reason for doing it? ...Would it be just as well to mail things to people or send attachments over email or some other way?... Do you actually need to speak to people in real-time or could you do that with a threaded discussion?' Those are all questions that I would want to ask.

> I think if I were to find ways to improve it…we [would] need to be really careful with it and thoughtful about why we are using it. Is it the right thing to use for that particular purpose? Being really, really clear on desired outcomes, I think would be really important. I think people need to learn how to collaborate. It is not necessarily a natural thing for people to do. Then you add that layer of real-time but apart kinds of things, and people need to learn how to do that as well. It is not the same as sitting down over coffee, for example. I think people could be supported and educated in that way. I think everybody needs to be in agreement ahead of time about what the purpose of the videoconference is and, I guess that goes back to why this and not that. Agendas would really help. I've been in a few where there were no agendas. You know, really good facilitation I think is important. I think of course, you need to ask the big accessibility question. Is this thing being exclusionary or inclusionary? I mean, you know, obviously you are going to exclude some people, but you should have a good reason to do that, or at least you need to be aware of why you are doing it.

Participant 14 took the opportunity to relay a lot of ideas in relation to improving collaboration within a videoconference environment. Most of Participant 14's ideas represent the general comments of other participants.

> Take into consideration the environment for each of the nodes in a typical session. All of the lighting should be around the periphery of the room and not directly overhead. This would change the angle of the light and put light onto the faces of people no matter which direction they faced. Light bouncing back toward the camera from fixtures near the corners (where the ceiling meets the wall) provides the best opportunity for seeing facial expression as well as gesture.

> If we can get past the current implementations of 'distance talking' with ways to 'reach through' the system and make emotional contact with participants then we will have entered a greater realm of distance learning.

Like most meetings it is usually about preparation. Having materials complete and available in all locations allows others to prepare or respond more effectively because they have had a chance to review it beforehand. A mechanism should be applied to the conference process for tracking and sharing documents without having to move documents, like a content management system, where anyone in the process can read back or track the progress of the collaboration.

What is also apparent is that some remarks get lost. I mean to say that some participants are waiting their turn and eventually they have to choose between holding their next comment or question in their head and responding immediately to what has more recently been stated. Judicious note taking is useful here but the immediacy of a face-to-face collaboration, which allows for interruptions or parallel interactions, can help a person avoid "tuning out" some of what is being exchanged in order to write down something for the near future. I've looked back on some of the note taking I've done in previous meetings and I'm often unable to connect those notes with my thinking at the time (for some this is true of any note taking during a lecture). I should be able to jump into the exchange when too many prepared responses stack up on my end.

The other thing about distance collaborations is the capturing and condensing of the exchanges or the presentations made by participants. It would be useful to have a system where members of the group can zip back and review what was said (conference TIVO?). This might naturally become part of a document tracking method in which each new entry is a chapter point in a continuing discussion. It is usually the case that a person wants to review the discussions which lead up or result from the introduction of a document in order to refresh their recall of the context in which it was received.

Mobility is the final frontier in videoconferencing. To date all systems operate from static positions, provide fixed views, require fixed seating arrangements, and centralize operational control in one or two areas. It should be possible to walk around a classroom and show distant participants closer views of what local participants may be doing. It should be possible for people in remote locations to provide their viewpoints from "wearable" imaging systems and for the leader/teacher/presenter to view those options and comment on their progress to the whole group (this is the equivalent of a teacher wandering between desks and leaning in to encourage or instruct an individual at their desk).

> Mobility also would allow for collaborators to change viewpoints, share perspectives on ideas, show sketches made while the presentation was going on, isolate particular documents or areas and for groups to form – similar to group work in a classroom.
>
> All of what I've been describing moves the experience more closely to actual classroom dynamics and the exchanges between teachers and individuals. The teacher as broadcaster has to be made extinct. The teacher as guide through the material and as a mentor to individuals in a group should be the entire focus of systems development so that adjustment of technique (to accommodate system limitations) by the teacher is no longer necessary.

Participant 12 was serious when stating that the way in which to improve collaboration within a videoconference environment would be to "shut it off and just do audio. That would improve it. People waste a lot of time messing around with the video. You see people's faces because of the lapse between the voice and the speaking…it puts people off."

Question Nine: How often is real-time collaboration within a videoconference utilized within the work you do?

The purpose of this question was to determine the frequency of which they relied upon the medium for collaboration (Figure 3). Based on the answers obtained, twelve of the seventeen participants used videoconferencing at least once a month. Three participants indicated they had stopped using videoconferencing to collaborate due mainly to projects ending.

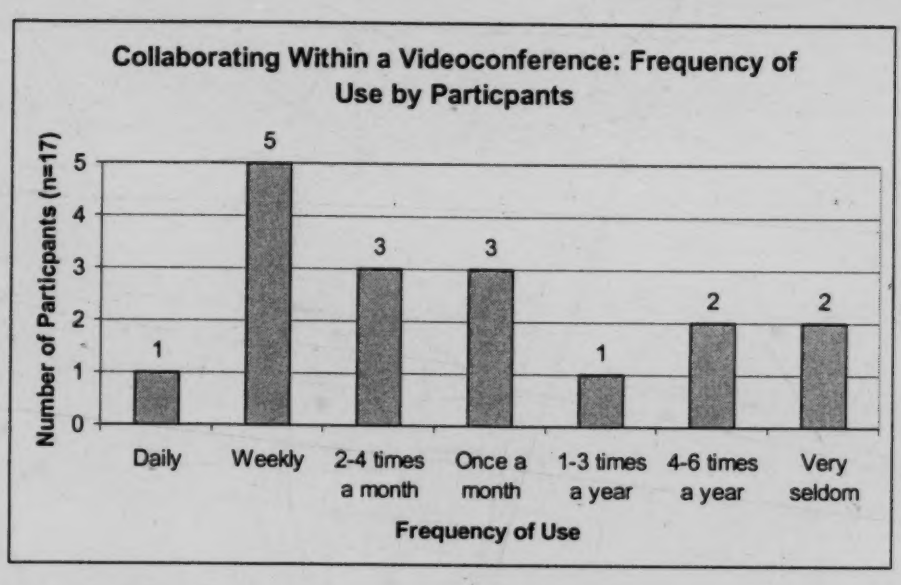

Figure 3: Illustration the Participants' (n=17) Use of Videoconferencing to Collaborate

Question Ten: What do you think is the most misunderstood concept about real-time collaboration within a videoconference environment? How, if at all, should it be changed?

This question sought to address what these "experts" thought were misconceptions that existed and how they could be changed. Were there misconceptions about collaborating within videoconferencing?

There was a large array of answers to this question. Eight participants noted that a major misconception about real-time collaboration within a videoconference environment is that a belief exists that everything will simply "just work" and therefore collaborative efforts will also "just work." Participant 7 noted: "I would suggest that [people believe that]...some kind of magic occurs in terms of the ability to collaborate." Participant 16 commented, "I suppose [the

most misunderstood concept would be] not having a back-up plan for it. If it does fail, what are you going to do about it?"

Participant 10 had trouble answering this question but focused on the fact that one should not assume communication will necessarily be effective because you are using this medium.

> I guess the misunderstood concept is the fact that people think just 'cause you can see', you talk to people that you can accomplish things, and communication is still a very, verbal communication...verbal digital communication is still the most difficult. When you write something down, you, you put your ideas down and people see what you've actually said. Even then there can be confusion and...misunderstandings, but you still have the same problems in videoconferencing that you do in real, direct contact, and I don't think people realize that. They get so excited by the whole, the whole idea of being able to see somebody from half way around the world, and be able to talk to them, that they, they don't plan.

Another misconception was that everyone in attendance will have a shared experience. Participant 14 articulates this point.

> What I find the biggest misunderstanding is that someone will be able to have a shared experience. This, I believe, results from the failure to recognize the true nature of the technology. As much as it appears to be simultaneous it is not. It can best be described as a distributed presentation system with feedback. Whoever is holding the floor is distributing their presentation to all other nodes while others have opportunities to provide feedback until the floor passes to another person. Feedback is never spontaneous or immediate (which is necessary for new ideas to form).

Participant 11 talked about technical considerations. "I think...people don't know the differences between ISDN and IP....People think that videoconferencing is still the old television conferencing when there used to be TV links, and so it's just building awareness of what it really is, and people knowing the difference. So it's educating really...is how we should change it."

Question Eleven: Can you describe your ideal videoconference/collaboration system? What are its main characteristics?

Responses to Question Eleven were varied. To appropriately detail all of the answers, I placed them within Table 3. This question generated many responses that can be of interest to those currently using videoconferencing to collaborate or those pursuing this medium as a means to collaborate. The most common responses stated how an ideal videoconference should be easy to use and operate, have high quality of audio and video, include installed collaborative tools, and be readily available to use.

Table 3: Participants' Description of an Ideal Collaborative Videoconference System

Ideal Videoconference System – Characteristics	Number of Participants in Agreement
Equipment & Technical	**30**
Collaborative tools present	*4*
Available all the time	*4*
Zoom controls on cameras	*3*
SMART Board™ / Electronic Whiteboard present	*2*
1+ screen	*2*
No audio and video lag	*2*
Large images available from remote site	*2*
Document Camera	*1*
Large audio visual (AV) screen	*1*
Multiple cameras	*1*
Automaticity – system identifies speaker	*1*
Creation of a "resource bin" to upload documents, schedule, agenda, etc.	*1*
Less complex	*1*
Closed captioning	*1*
Full motion video	*1*
No technical glitches	*1*
Sessions are recorded	*1*
Standardized systems	*1*
Administration & Other	**11**
Easier scheduling with other participants due to their schedules and not videoconference room schedule	*2*
Low associated costs – cost effective	*2*
Have discretionary time to think about collaborative efforts rather then the technology	*1*
Have as a research environment	*1*
Increased comfort with video recording sessions	*1*
Getting over societal issues about saying anything if it is being recorded	*1*
Technician present	*1*
Participant awareness and preparation	*1*
Back up plan in place and known to all participants ahead of time	*1*
Operability	**8**
Easy to Use & Operate - Ubiquitous	*7*
User-friendly interface	*1*
Connectivity	**8**
Higher quality of audio and video feeds	*6*
H.323 connection	*1*
Easy connections to remote sites	*1*
Location & Videoconference Room	**5**
Larger room capacity	*2*
Professional room set-up - resembling a television production studio	*3*

Participant 1 commented that an ideal videoconference system would be "ubiquitous…it has to be so that I can have it on my desk, when I go home…when I'm travelling…it has to be there. Second, it has to have data sharing." Participant 9 also wanted a videoconference system that was easy to use: "Easy to operate. Easy to arrange common time with other party or parties." Participant 5 commented, "I think the ideal system would have or would include all types of collaboration tools…whiteboards, document sharing…it would include the possibility to work on documents at the same time."

Participant 15 typifies a response regarding high quality audio and video.

> You need really good video and more importantly, really good audio. There's nothing worse then losing sound…when people are writing things down, holding up signs that you can't read…it's just not videoconferencing at its best. If there is really good sound…that's the most important thing.

Some of the more unique responses include comments from Participant 10. "I think that you have to have a minimum of two screens with the people on it, and one working screen where you can have documents that you can share and show people or collaborate on. I think that you need to have a system that automatically identifies the speaker." Participant 14 talked about delays in audio and video feeds.

> Zero delay and image clarity on the order of an open window. When it becomes possible for participants to set up parallel tracks of discussion while a presentation is being distributed – and for people to act less formally in their exchanges (that is more spontaneously) – then we will be able to conduct true collaborative exchanges. A person should be able to 'lean over' to the next node and whisper or comment on the proceedings without having to 'switch' or interrupt the presenter. In many cases the best collaborations between people happen while they are attending to other activities.

Participant 11 felt it was hard to define an ideal videoconference system. "Oh, that is hard to say. Do you know why I answer that way? - Because it depends on the use. If I had an ideal system for piano, then it would be in a piano studio. I'd have all these fancy microphones and a camera that would zoom in on my hands. If I'm teaching, then I would probably have…a whiteboard, obviously cameras…something to share data."

Question Twelve: Does using a videoconference environment change the way in which you collaborate with your colleagues/peers?

Question Twelve sought to answer the third research question of this study. That is, does videoconferencing change the way in which educational researchers collaborate? All seventeen participants commented that using a videoconference environment changed the way they collaborated, either positively or negatively. Where there was differentiation was on the degree in which it did change collaboration. "It causes you to be a little more structured and attentive to protocol, attentive to detail, and you know, following of agendas, and this…sort of thing…it forces you to run a better meeting then is sometimes the case in the face-to-face context" (Participant 17). Participant 1 stated:

> It usually takes at least another ten minutes of set-up time, so there's ten minutes wasted if you use the videoconference. And in a positive sense…a typical understanding of it is that is more important at the beginning when you don't know these people…if the comparison is with face-to-face, I think videoconferencing is…shorter and tend to get down to business quicker, and get distracted least often."

While Participant 16 stated:

> It allows you to participate in collaborations that you might not have normally done or collaborate in more meaningful ways then you would have. Instead of having ten people on a phone call trying to talk, putting those people on a videoconference for a meeting, would add value to it. It will increase the collaborations I think, and the collaborations can take place that don't normally take place.

Participant 10 furthered this response:

> I would have to say 'yes' primarily because it gives me more opportunities for meeting where we all get to decide, and you get to clarify problems much more quickly...it just makes it much more convenient.

Participant 7 commented on the fact that videoconferencing inhibits spontaneity of collaborative initiatives that usually occur when colleagues are face-to-face, but still agrees it has some effect.

> I'm not sure it really has significantly....I suppose we have some more interactions because we are using some of the tools, but where things are important we probably would have got together anyway, so no....I don't think it's become that key of a tool in the collaborative process yet. I think it's assisting but I don't think it's made any fundamental changes in terms of...how willing we are to work with somebody...the most exciting collaboration is when I...have an idea and I pick up the phone, or walk down the hall, and we start to move forward on this...you can't have spontaneous videoconferencing. It has to be planned out and worked out and all that...so I think it...hasn't changed my collaborative approaches all that much.

Participant 4 noted the negative effects on collaborating when using videoconferencing as it can impose physical barriers.

> I can't think of any way that is has, per se. I mean obviously the usual issues of, well...I'm not in the room with you, and all of the things that implies, but fundamentally no. I think you go into....a collaboration with your team, and with everybody agreeing to accomplish something, and you have the usual sort of understanding of people's strengths and weaknesses and how they all fit together, and that's sort of...happens. It happens naturally. It

> feels right, and the videoconference is almost inconsequential to that feeling, if you will (Participant 4).

Question Thirteen: In your opinion, what is the ideal method of real-time collaboration?

Nine participants indicated a preference for face-to-face collaboration. "In my opinion, the ideal method of real-time collaboration is still face-to-face" (Participant 3). Participant 14 furthered this by stating: "Nothing substitutes for face-to-face, in the same room, loud, boisterous, challenges and mistakes, and the spontaneous inspirations – which come from a shared information space." Participants 13 and 2 respectively agreed:

> To be frank, my ideal method of real-time collaboration is face-to-face contact with someone. I work far better being able to read someone's body language and tone. Being able to convey my own body language and tone…I just quite frankly would prefer not to have to deal with the technical issues that videoconferencing often brings up.

> Face-to-face. I'm a traditionalist. I just feel that it is so key to be able to meet somebody and handshake or, you know, a face-to-face smile or getting to understand people's emotions and how they react to different things when you are in the room with them, I think really perpetuates a sense of understanding of that person and understanding of the characteristics that you may be forced to deal with down the road.

The remaining eight participants varied on their responses to this question. For instance, Participant 1 commented that an ideal method of real-time collaboration would be to, "use videoconference in…real-time [with] audio and data sharing as required…it would by my ideal" and Participant 4 commented:

> I think any project is going to require kind of multiple levels…If you're talking about doing something in a country this big, which I hope we do, you know, let's face it, it's a country of remote communities, and there is a reason why we are having this

> conversation in this country....So it's all...in terms of preference....I think it's just all part of the mix, and...given the nature of the country, I think it's...got to be an essential part of the mix....Videoconferencing is suitable for certain things, and there are certain aspects to the process that you want to be face-to-face, so, I don't know if I would favour any of them. But what I think I would favour is coming to understand what is best done by what means.

Participants 5 and 9 respectively provided some humour to this question by commenting on all expense paid trips as well as having a mute option.

> Well, if I got to fly to Vancouver, I would like that better and spend a week there with all expenses paid. The thing is I don't think there is an ideal method. I think it goes back to what you want to accomplish. What are your outcomes? Who is involved?

> There are some benefits to videoconferencing...if somebody is [annoying] me...I can shut off the audio, and I guess that there's just a little bit of a...distance, so I might have more opportunity to frame my thoughts before I have to jump in and...speak to an issue...videoconferencing gives a little more time to reflect on a contribution, and in all honesty, I can always say, 'oh, got a phone call', pick up my cell, and run out the room, and then go outside and swear in the hallway about what kind of jerk I had just been talking to.

Participant 6 commented on appropriate technology supports that are needed when collaborating in a videoconference environment.

> The ideal method would be having the identified technology at one's fingertips with appropriate technology supports that can enhance the environment, everything from electronic whiteboards to document cameras to multi-function printers to instant messaging and then having...a process in place that can effectively train individuals to...use the technology properly.

Question Fourteen: Open ended

Fourteen of the seventeen participants took the opportunity to provide additional commentary within the open ended portion of the interview. Some of

the participants elaborated on points brought out by the previous questions, while others talked about their personal experiences with videoconferencing in a variety of contexts.

The major points brought forward by this question can best be summarized by the following categories: Alberta SuperNet could be a catalyst towards securing videoconference standards; videoconferencing can increase collaboration among groups, a need still exists to consider accessibility issues with regards to videoconferencing, a specific purpose in using videoconferencing and the technology within a videoconference suite should be kept in mind when acquiring it, and videoconference users should be critical of the technologies they use.

Participant 17 talked about the Alberta SuperNet and the potential opportunities it may bring once installed and in working order.

> The Alberta SuperNet may prove to be a catalyst that…moves us in the direction of standards, that moves us in the direction of better information sharing about who's doing what, that perhaps catalyses some research into the effectiveness of videoconferencing in various contexts, best practices, and stuff like that.

Participant 2 took the time to comment on how videoconferencing can bring about a sense of freedom that these environments can lend themselves to.

> Any additional thoughts might be that as you go through the years, and you see the advancements happen not only for just the collaboration between groups, but interaction that a high-level videoconferencing system can bring to people that would, in a normal basis, not have that collaboration. It opens up a sense of almost freedom to people in environments that allow the collaborative groups… [to have] much more conversational and potentially creating environments that allow the collaborative groups to much more communicative between them and put them

> in a position to better understand people that they are collaborating and speaking with.

Participant 5 took the opportunity to give a precautionary note about the use and selection of videoconferencing equipment.

> I do want to emphasize that...we all have the tendency to sort of dash off to the next technology and think it's the cat's pyjamas. But, we don't ask really critical questions like we should. In particular, my critical question/emphasis is inclusion. Real-time collaboration really excludes a lot of people for lots of reasons. For gender, for age, for language, for access, for experience...you know, just for a lot of reasons. I think we need to be really critical about that.
>
> There are still challenges to overcome. We see it as...one type of technology that can support, for example, the delivery of...learning, but certainly not the only one....I guess when you're looking at an implementation of it you have be understanding of what you're trying to solve, what was your problem in the first place and...how is it going to address that. So, there's many different things in...terms of cost analysis, and return on investment of the technology, certainly dropping in price, but it's...not the only way that learning can take place, but it certainly is a supporting role that it can have with the delivery of learning, and administrative, and say professional growth activities (Participant 6).

Participant 11 talked about the quality of equipment needed in videoconferencing.

> I do think that quality does matter for certain applications, so if I was teaching, say violin, or I was teaching piano, then I would really like high quality, or art, but for just me talking and disseminating straight information, then it's okay to use lower band. So...I guess it's just I minimize the competition between people that you see right now because it still is sort of leading edge, and it still is, we're at an early stage in the dissemination of this type of equipment.

Participant 4 took this opportunity to relay experiences during a videoconference project involving high school students taking classes via videoconference.

> When you take a structure that is kind of authoritarian—like a classroom—and then you suddenly disperse it...you distribute it... authority suddenly becomes dispersed....The minute you remove somebody from a room...its hard enough to keep a classroom under control, so the minute you disperse it...it seems like what that is calling for is a kind of give and take sort of relationship that would encourage a collaboration over distance that would make the kind of classroom project versus the classroom lecture more suitable because then, you're engaging.

Participant 9 commented about videoconferencing as an instructional mode to various civilizations and offering a variety of educational programs.

> Videoconferencing is an instructional mode to remote parts of civilization....We taught welding theory by videoconferencing to students in five different locations by using some bridging, some fairly expensive costs were incurred, but we were able to change the dynamic of needing a cohort size in one location. Right now if you wanted to take a course in [XYZ], you would have to find an institution who is already been able to get 12 others...whereas with videoconferencing, and the kinds of affordable SuperNet connectivity, then we can do away with that cohort requirement, and we can teach to the Alberta classroom, if you will, as soon as we find 10, 12 people across the system that's exciting. A second free comment is that videoconferencing has the power to challenge the old requirement of trade and apprentice students leaving their job for a period of the apprentice instructional time somewhere, either 8 or 12 weeks depending upon the trade, by staying on the job, taking videoconferencing in the evening and being able to go back into their real and current work environment the next morning to say, hey, my instructor...showed me how to hold the brazing tool this way and do an angle weld. And the journeyman who is now...an employer or a colleague at work, and now part of that person's training can say to them, well, look, you've got this project work to do until just after lunch, I'll come back and we'll make sure you get some time to try that. So we have a chance with videoconferencing to change the dynamic of apprentice curriculum delivery of theory.

Participant 16 talked about the lowering of pricing often associated with videoconferencing.

> I think I more or less covered everything other then I think...I think videoconference will come down in cost and I hope it does. It will make it more accessible for people and as people get more experiences with it, and learn to use it effectively in the right way, as that is sorted out, that it will have a lot of value added to...I guess if we focus on Alberta and the learning system here, what we are trying to do and how people work together in getting things done...So, I think SuperNet ties nicely into that because it is an enabler to reduce cost and increase access to it as well.

Participant 13 was the only participant who talked about disparities between videoconferencing standards and equipment within other nations.

> I kind of said this before, but I would like to reiterate that I really feel when videoconferencing initiatives are being created, being implemented, more consideration needs to be given to the actual users of the system....In the project I have worked on, they used expert knowledge for the main foundation for many of the decisions that were made. As a result, there are issues that could have been resolved if a larger variety of people were consulted and taken very seriously....
>
> Another issue...is a huge discrepancy between the level of technology in Canada and other nations. We do videoconferencing all over the world and we have to maintain a number of communication protocols and videoconferencing protocols, because so many countries are so far behind us. Now MPEG2 is emerging as the standard protocol, many universities...we connect to outside of Canada and United States, have a protocol called H.323, which is a little bit behind. We also have countries we connect to that are using even more antiquated technologies like ISDN videoconferencing. So, that's a struggle to maintain and document all of those types of processes simply because we are ahead of the game here. We really are in terms of large scale videoconferencing. So that is a frustration to deal with. The other issue, [we have] a number of times connected to third world countries who had equipment set-up, and not even third-world countries, Mexico, even for example. Equipment set-up for them by other institutions or they have paid organizations to set this up for them, then they don't necessarily have anyone who knows how to run it properly....It's been a real struggle to not only educate the

> people using it on our end, but having to educate the people on the other end because they are using technology that they are not necessarily...a skill that level to use effectively. So that is a real frustration for me. I find in those types of situations that I end up doing more collaborating with the tech people in other locations, then the actual people I am doing the videoconferencing with. In some ways it is very beneficial for them, because they are learning from us but from our end, that tends to be more of a frustration. We don't really get anything. So maybe collaboration maybe not the right word for that. The collaboration of the actual people that are supposed to be doing the videoconference is often overshadowed by the collaboration between the technology people.

Participant 14 commented about the fear of technology that some users face when conducting or participating within a videoconference.

> What I hope to see is the development of a new distance learning technique, which takes up this challenge and finds ways to induce thinking over a distance. My only fear is the use of this technology may make people more uncomfortable.

Participant 15 commented on the importance of deriving a purpose for having additional technology rather then acquiring technology and then deriving a purpose to use it.

> There's a need for a kind of...reformatting, reintroducing, re-something around videoconferencing. There's a lot of...people often when they see videoconferencing the first time, their first impression is negative. Why is there this delay?....I think that the potential of the technology has done things to make it a more exciting way of operating but we need to approach it a different perspective...maybe the videoconferencing itself needs to be secondary to...kind of the synchronous ability to do kinds of things, and when you need the visual side of it it's there, but your focus isn't on the videoconferencing per se because, I mean, it is some older technology and, and it still can be quite expensive to bring together more then two sites...
>
> Point-to-point's fine, but if you want to bring multiple sites, and that's...something we've got to get better at. But we also have to figure...out better ways of doing it because when you split a screen eight ways you're not, even if you blow it up and project it into a huge screen, you're still not really effectively going to be able to

deal with it. You need to be able to rotate, switch through things, [and] do things that are in a meaningful way without a lot of thinking. On picture-[television], this is really expensive, but it does have the ability of picking up voice, and zooming in on you automatically and, and that kind of thing, that's the kind of thing you, it need, is needed if you want that to be effective in...[a] group because, again, otherwise you have to devote a lot of resources to doing it manually and, and that's, and in this day and age that's, its hard to find that kind of time or relevance.

So...I think that we need to think about, and we need to start to orient not just this technology, but most technologies so that we're fitting a particular purpose not the other way around. 'Oh, here's a neat technology, lets go use it and we'll find some useful things to use on the way'. But if, you know, I mean, obviously if you're diagnosing patients remotely, you know, it has a huge role to play, and, but that fits, that's doing something that you couldn't do otherwise in a meaningful, you know, and I think that's true in a lot of other synchronous, but we need to start to think about the task, so once, if we can define the task and what we want, that should then suggest which technologies get used, and videoconferencing is, is one of those pieces that can be pulled into that ideally as flexibly as possible. But its not, but the technology itself, I mean, I remember going to Disneyland when I was much younger, and you know, there was Tomorrow Land, and in Tomorrow Land there was picture phones, and the idea was that in another five to ten years these would replace your common phones, and we'd be using them, well, we don't have them yet. I mean, we've got them in, you know, and, and there's a reason for that. You know, most people don't want others to see them, you know, and, and so, which is a problem. If they did, then we wouldn't, then we would be having picture phones on our, our phone...but it was a technology, and it didn't match what the needs were of the people. You know, when it does, it gets used, so we need to be thinking more around, how we can facilitate whatever it is that we're doing, and then this is just one of the tools that we bring in. I think I've said enough now...too much.

Summary

This chapter presented the data obtained from interviews conducted with each of the seventeen participants. All seventeen participants were known experts within the field of educational research as well as videoconferencing

collaboration. Using a carefully constructed interview guide, fourteen semi-structured questions were asked. I ensured that I allowed opportunities for each participant to elaborate on any point or thought that arose during the interview process. Since there were so many data, I deemed it appropriate to organize the data by each interview question. The interpretation of this data will be explored in Chapter Five.

CHAPTER FIVE: DISCUSSIONS AND RECOMMENDATIONS

Introduction

The research objective of this study was to gather and examine the experiences and thoughts of educational researchers who had collaborated within a videoconference environment in order to determine if videoconferencing is an effective medium. In the previous chapter, I presented the findings of the seventeen interviews that were conducted. In this chapter, I will determine if the data answered the three research questions, as well as assess whether the research objective was achieved.

This chapter will provide a personal reflection of the overall experience I had conducting the interviews with the seventeen participants. I will also examine the three research questions, how they relate back to the literature presented in Chapter Two, as well as the implications of these findings to educational researchers and perhaps other practitioners using videoconferencing as a means of collaboration. Finally, I will provide suggestions for further research, provide a comprehensive checklist that educational researchers can use when collaborating in a videoconferencing environment and make concluding remarks.

The first research question sought to identify the strengths and the impediments to collaborating within a high-bandwidth videoconference environment. The second research question sought to determine whether information is effectively disseminated within a collaborative videoconference environment, and the third research question sought to determine if videoconferencing changes the ways in which educational researchers collaborate.

To answer these questions, purposive sampling of experts within the field of educational research and videoconferencing collaboration was conducted, the process of which was detailed in Chapter Three and the results of which were detailed in Chapter Four.

Research Question One – Strengths, Weaknesses, and Impediments of Videoconference Collaboration

Question Four of the interview asked, "What do you see as the greatest strength(s) of collaborating in a videoconference environment?" and Question Five asked, "What are the greatest weaknesses/impediments to collaborating in a videoconference environment?" Both of these questions directly related to the first research question posed in this study. There was a variety of strengths as well as a variety of impediments cited in the interviews, as outlined in Chapter Four.

The main strengths of collaborating within a videoconference environment that were identified included a visual presence of all attendees, perception of a larger sense of community, the opportunity to share data between sites, enhanced communication which allows for a more humanizing process, the potential for new possibilities, elimination of travel, an increased social presence, an outlet for creative expression, cost effectiveness, audio and video connections, increased accessibility, and the allowance for synchronous communication.

All of the impediments were also outlined in Chapter Four. The main impediments identified by the participants were the requirements of having a certain level of knowledge and skill, the fact that meetings are often interrupted by various technical problems (e.g.; latency and network issues), there are costs

associated with purchasing and maintenance, often there is a lack of visual detail usually stemming from poor quality video, learning styles are at odds when trying to collaborate, and the entire process requires preparation and is not ubiquitous.

It was not surprising that many of the strengths and impediments cited by the participants were ones identified in the literature reviewed in Chapter Two. For instance, similar strengths identified both by the participants and in the literature include visual cues, reduction in travel, enhanced communication, cost effectiveness, sharing of information and creativity were addressed (Boutte & Jonés, 1996, Brady, 2001; Crawford, Sharpe, Chun, Gopinathan, Ngoh & Wong, 2002; Czeck; 1997; Davis & Weinstein, 2002; Finn, 1997; Hearnshaw, 2000; and Jennings & Bronack, 2001).

The ideas that videoconferencing could create a larger sense of community as well as increasing accessibility were not areas that were found in the literature. Participant 5 talked about the need to consider accessibility issues when choosing a medium with which to communicate, but this study did not examine any literature pertaining to videoconferencing as a means of increasing accessibility or literature pertaining to accessibility issues in general. I think examining the sense of community as well as accessibility issues within collaborative research within a videoconference environment is an area of research that should be pursued.

The majority of the impediments that were identified through the interviews were addressed in the literature. This study affirms that technical problems, required knowledge and skill, poor quality equipment, and the total

costs of purchasing and maintaining a videoconference system are impediments to collaborative efforts.

The impediments discussed by the participants in this study that did not directly correspond to the literature presented were the issues of learning styles, people's perceptions, relocation, lack of networking opportunities, and the imposition of a more formalized process. In my opinion, these impediments should be further examined to generate more research and validate these claims.

Research Question Two - Dissemination of Information

After reviewing the responses for Question Seven (i.e., is knowledge/information effectively disseminated to the other participants within the videoconference environment), I concluded that knowledge and information can be effectively disseminated to other participants within a videoconference environment. Twelve of the seventeen participants answered "yes" to this question while the other five participants indirectly answered positively to this question. In other words, all of the participants, based on their experiences, believed that knowledge/information was effectively disseminated to the other attendees within a videoconference environment.

These findings help support the claim that videoconferencing is an effective means by which to disseminate information (Schweizer, Paechter, & Weidenmann, 2003). Participant 17 responded that videoconferencing "can be very effective in that regard because your communication can be multi-modal…it can be verbal, it can be through presentation software like PowerPoint…there are

variety of modes of communication that videoconferencing permits, so I think knowledge dissemination works quite well."

Research Question Three - Videoconferences' Effect on Collaboration

After reviewing the responses from Question Twelve (i.e., does using a videoconference environment change the way in which you collaborate with your colleagues/peers), I can draw another conclusion. Seventeen participants (100%) commented that using a videoconference environment changed the way they in which they collaborated with their peers/colleagues.

> Using a videoconference environment definitely changes the way that we would collaborate with peers/colleagues. You have two choices without videoconference set-up, you are going to be doing face-to-face, which let's be honest, is probably 90% of the time would be our first choice. However, given the fact that we can't always do that based on time, monies, distance limitations, then the videoconferencing is so much better (Participant 2).

Therefore, I conclude that videoconferencing as a means of communication will have an effect on collaborative efforts.

Other Findings

Several other findings emerged from the interviews. One finding was that consideration needs to be given to the type, purpose, general audience, and possible accessibility issues that could arise with users of any given videoconference system. When purchasing a videoconference system, the question of purpose and the intended users should be at the forefront of the decision-making process. The tools and technology within any videoconference system should be somewhat ubiquitous. Cost should also be part of the decision-

making process. To determine an appropriate price range, frequency of use should be determined.

Another finding was the variation in the ways in which the participants defined videoconferencing. For this study, I had chosen the definition provided by SearchMobileComputing (2005).

> A videoconference is a live connection between people in separate locations for the purpose of communication, usually involving audio and often text as well as video. At its simplest, videoconferencing provides transmission of static images and text between two locations. At its most sophisticated, it provides transmission of full-motion video images and high-quality audio between multiple locations (¶ 1).

This definition focuses on the geographical separation of local and remote sites, the audio and video feeds required as well as transmission of images. The participants touched upon other areas that can define videoconferencing.

Participant 13 noted that videoconferencing was a means of communication. Participant 5 noted that videoconferencing was a process with pedagogical implications, Participant 1 stated, "videoconferencing…I guess I think that assumes you have audio conferencing, and that you have some sort of an image picture there of the participant." Participant 16 commented that videoconferencing also has to include "the various types of technologies and ways of doing it" while Participant 14 focused on learning and growing through the exchange of information. Participant 15 summarizes this point well:

> A lot of people have pretended to use or tried to use videoconferencing with [a] kind of narrow definition of 'oh, I can just continue to do what I have been doing and now I will be available at a distance.' But for videoconferencing to really be effective, it has to be ideally quite different from what you do normally. You have to be paying careful attention to what people

> are doing remotely as well as what they are doing near, if you have people at both locations, or multiple locations. If you want discussion, you have to do things explicitly to get that discussion. You have to do a lot of things you wouldn't explicitly do if you were all in the same room together, in order for it to be effective. So, it's a way of bringing people together using one type of technology together collectively as a group in a real-time, synchronous event. But, I guess...effective use and use are two different things. I don't know...I guess that would be the definition. Although, you could, I mean normally it's synchronous but you could certainly store...video tapes to other things, so that in fact it's asynchronous but you still have capacity to email or to talk to a person or do other things so that it could even work in that kind of environment. We don't think about that normally.

The perspective of Participant 12 on collaboration and videoconferencing was very different then the rest of the participants in this study. When I first contacted Participant 12, I received the following email response: "I am not a big believer in the benefits of either collaboration or videoconferencing, but if you still want to talk give me a call." Looking back, it was unfortunate that I did not further explore this participant's thoughts and feelings on this matter.

A major issue that re-emerged throughout this interview had to do with latency problems. Latency problems often lead to lack of synchronization between audio and video.

> I think the greatest problem with it is the delay in speaking and that delay makes it look like you're speaking does not conform to what you are saying with your lips and people tend to, whether they know it consciously, form a negative opinion of the speaker because their lips aren't matching.

When describing an ideal videoconference/collaboration environment, Participant 12 stated it would include, "Full-motion video...no lag in speaking and it would be seamless to the user so the technology is not difficult to use and you don't even notice it is there."

This perspective was very different then that of Participant 9 who did see the value of collaboration within educational research as well as value and prefer to use videoconferencing as a means by which to communicate. For instance, Participant 9 was the only participant who prefers videoconferencing to any other method of communication: "Videoconferencing gives a little more time to reflect on a contribution" and humorously continues "in all honesty, I can always say, 'oh, I got a phone call', pick up my cell, and run out of the room, and then go outside and swear in the hallway about what kind of jerk I had just been talking to. Maybe I could do that in a face-to-face, too. Oh, wait a minute…I got a cell call…got to go Karen!"

The issue of using IP versus ISDN was brought up by some of the participants. Participant 15 considered IP unreliable and would prefer using phone lines. Participant 1 commented on the unreliability and lack of robustness of IP videoconferencing.

> The continued lack of reliability and robustness in the IP videoconferencing that I've been participating in to date seems to come and go…you lose people…somebody's complaining you spend a lot of time waiting for everyone to get everything tweaked up and ready to go. ISDN videoconferencing systems were, in my experience, a lot more reliable but they required people to go to a separate room, they weren't desktop things, they were more videoconferencing suite setups, and they are very hard to maintain financially, and to support with people. You need somebody to help hold your hand while you're doing it, and controlling the cameras, and all this sort of thing, so they're just very expensive.

Comments such as these made me think about how mainstream videoconferencing technologies have become as users move between IVC and DVC for collaboration. A trend is emerging whereby expert videoconference

users are not experts with various technologies within the systems being used, but they are becoming experts in using the technologies. The lack of expertise with the technologies could lead to an interesting dilemma as the use and reliance on videoconferencing increases. This is certainly an area for future research.

Most of the participants did not talk about the more technical side of videoconferencing. Two possible explanations for this could be due to lack of understanding or expertise with all of the technical components of videoconferencing, or that they did not feel these issues were relevant to the questions presented. This study did, however, only focus on high-bandwidth videoconferencing. That being said, I think it is important to note that there are different types of videoconferencing being used for collaborative initiatives within the field of education.

As an educator, it is important that appropriate steps have been undertaken to ensure that the target audience or participants of the videoconference session are minimally literate with the technologies present. If the presenter is not technology literate, then a technician should be secured for the duration of the meeting to handle the set up and shut down of the equipment as well as address any technical issues that arise.

Participant 14 was the only participant to address learning styles. The literature reviewed in Chapter Two stated that the field of education is transforming from a competitive model to a more collaborative model (Hardwick, 2000). This collaborative model has led to a more student-centred approach, thus touching upon learning styles (Smith, 1985; Bruffee, 1987; Slavin, 1987 as cited

in Hardwick, 2000). What are the learning styles of educational researchers? I would propose a future study within this area with a focus on whether learning styles of educational researchers effect their perception of the effectiveness of videoconference collaboration.

Participants 7 and 17 respectively talked about the lack of shared standards within the province of Alberta. Alberta currently has no provincial standard for videoconferencing. With no such standard, technical difficulties and user frustration can arise. VCAlberta.ca is a website that provides resources for Albertans such as offering advice on videoconferencing standards wishing to videoconference (VCAlberta.ca, 2004). This is a good first step in initiating dialogue about these types of issues that often affect the use of videoconferencing. I believe research into the necessity of shared standards within Alberta for videoconferencing should be carried out.

Another finding from the interviews was that there appears to be a substantial growth of videoconferencing initiatives and collaborative ventures within the field of education in Alberta. For instance, there are currently five different school divisions within Alberta using IP videoconferencing in various teaching and learning opportunities (VCAlberta.ca, 2004). Several of the participants mentioned the RACOL project and some mentioned work they were currently carrying out.

> This morning my boss is in Banff and he has a personal video camera on his laptop and so do I. He dialled me this morning for about eight minutes to talk about some things. He is sitting in a coffee shop and naps before his meeting. We dealt with the issues and it was much better then trying to figure it out over the phone,

plus there were no long distance charges or anything. We just collaborated visually.

Based on this data and the experiences shared by the participants, the field of collaborative research using videoconferencing seems to be on the rise.

Implications of Findings

The findings of this study are compatible with the literature presented in Chapter Two. Due to the fact that qualitative interviews were used as a methodology in this study, findings can not be generalized nor can any generalizable statements be made. However, within this study, some comments can be made:

- Videoconferencing can be used to effectively disseminate information to other attendees.
- There are clear strengths and clear weaknesses/impediments of collaborating within a videoconference environment.
- Videoconferencing has an effect on collaboration. This effect can be positive or negative as described by the participants when they detailed the weaknesses and strengths of collaborating within a videoconference environment. A positive effect could be creating a sense of community while a negative effect may be frustration due to technical difficulties.
- Videoconferencing can be tailored to an intended audience.
- When organizing a collaborative session using videoconferencing technologies, ensure that accessibility issues are addressed.

- When organizing a collaborative session using videoconferencing technologies identify potential technical difficulties that could arise, and/or acquire the knowledge, and/or skills to operate the videoconference system, and/or ensure that an appropriate technical person is on stand-by.
- When organizing a collaborative session using videoconferencing technologies, ensure that all participants are prepared and informed of the purpose of the session, have the agenda, and are aware of the back-up plan. The session should be treated the same as, if not more carefully than, a face-to-face meeting in that agendas are disseminated, equipment is tested, information is disseminated ahead of time, attendance is taken, and activities and conversations are engaging.
- When leading a collaborative videoconference session, explain videoconference etiquette to participants who are not familiar with the technologies or the process by which it operates.

Checklist

Based on the qualitative data presented in Chapter Four as well as the literature reviewed in Chapter Two, I have assembled some pedagogically-based strategies educational researcher can use. In general terms, effective strategic purchasing of a videoconference system as well as planning for a videoconference collaborative meeting is essential to address in order to achieve overall success. Furthermore, the critical things to share with all participants of a collaborative videoconference meeting include the technical specifications of the

videoconference system in use, the agenda of the meeting, the back-up plan, as well as proper etiquette.

Appendix B is my compilation of strategies for educational researchers who are planning a collaborative videoconference meeting based both on the data analyzed from this study as well as the works of Downs, 2004, East Carolina University, n.d., New York Network Online, n.d., VCAlberta.ca, 2004 and ViDe, 2005.

Recommendations for Future Research

Based on the literature and the results of this study, several recommendations for future research can be made.

- Longitudinal studies of educational researchers who regularly rely on videoconferencing as a means of collaboration should be conducted to not only validate my findings, but to explore them in more detail. Using observation as a methodology for collecting data would be interesting approach to take.
- The interview questions used in this study could be expanded. Future questions could include exploration of participants' personal experiences of collaborative efforts, how much value they place on videoconferencing and its technologies, having participants comment on the created list of pedagogically-based strategies (determine its effectiveness), and having every participant theorize on ways in which to collaborate using videoconferencing in the work they are doing using videoconferencing.

- A survey or questionnaire could be administered to a larger audience including those not within the field of educational research from whom quantitative data could be obtained.
- With the final installation and deployment of the Alberta SuperNet, research on the evolution of existing collaborative initiatives that use videoconferencing systems should be undertaken.
- A study addressing accessibility issues with different type of user groups should be undertaken to assess whether socioeconomic factors contribute to perceptions towards, and use of, videoconferencing to collaborate.
- A study focusing on the sense of community or communities that can emerge within collaborative research using videoconferencing as a means of communication should be undertaken.
- A study that identifies the learning styles of educational researchers using videoconferencing as a means of collaboration and its effect on perceptions towards the effectiveness of the medium should be undertaken.
- A study focused on defining the importance of communication within education and within a videoconference environment should be undertaken.
- A study that demonstrates that expert users do not equate with expert videoconference technicians.
- A study investigating the reliance or lack of reliance of expert users on technicians within the field of education when collaborating within a videoconference environment.

- A study on expert users' knowledge of the technologies within a videoconference system and how that could effect collaboration.

Conclusions

In Chapter One, I detailed my experiences in the RACOL project as well as the work being done by colleagues. Both of these experiences led me to articulate the three research questions this study sought to address. Chapter Two detailed literature within the field of videoconferencing and videoconference collaboration. Chapter Three overviewed the research methodologies used while Chapter Four presented the data collected from seventeen participants who were experts within the field of educational research and collaboration within a videoconference environment.

As a result of this study, I believe it is fair to state that videoconferencing is a very effective means by which educational researchers can collaborate. Seventeen participants shared their experiences and thoughts towards collaborating within a videoconference environment, and all indicated that they would collaborate using this medium again despite the challenges that can face the use of this medium. I feel I have achieved my research objective by answering the three research questions and stating that videoconferencing is an effective medium.

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Appendix A: Interview Questions

Stem	Probe	Research Question
Question One: In your own words, how would you define real-time collaboration?		1
Question Two: In your own words, how would you define videoconferencing?		1
Question Three: How much value, if any, do you place on collaboration?	Explain.	3
Question Four: What do you see as the greatest strength(s) of collaborating in a videoconference environment?	Why?	1
Question Five: What is the greatest weakness/impediment to collaborating within a videoconference environment?	Can you elaborate?	1
Question Six: Would you use collaborate using videoconferencing again?	Why?	3
Question Seven: Was knowledge/information effectively disseminated to the other participants within the videoconference environment?	Explain.	2
Question Eight: Can you theorize on ways in which to improve collaboration within a videoconference environment?	Can you provide a specific example?	3
Question Nine: How often is real-time collaboration within a videoconference utilized within the work you do?	I'm looking for frequency.	3
Question Ten: What do you think is the most misunderstood concept about real-time collaboration within a videoconference environment? How, if at all, should it be changed?	Explain.	1
Question Eleven: Can you describe your ideal videoconference/collaboration system? What are its main characteristics?		1, 3
Question Twelve: Does using a videoconference environment change the way in which you collaborate with your colleagues/peers?	Explain.	1, 3
Question Thirteen: In your opinion, what is the ideal method of real-time collaboration?	Why?	1, 3
Question Fourteen: Open ended		n/a

Appendix B: Pedagogically-Based Strategies for Educational Researchers Collaborating Within a Videoconference Environment

	Local Site	Comments	Completed
Before the Videoconference Meeting	State purpose of collaborative meeting.		
	Determine if videoconferencing is the appropriate medium meeting.		
	List all attendees		
	State location all sites		
	Determine what equipment is available		
	Determine codec(s) at all sit		
	Determine collaborative tools being used		
	Determine who the technician is at local site -Name -Contact Information		
	Determine who the technician is at remote site(s) -Name(s) -Contact Information		
	Create an agenda		
	Disseminate the agenda to attendees		
	Test or have equipment tested ahead of time (Microphones, cameras, lighting, audio, connection, etc.)		
	Disseminate and discuss videoconferencing etiquette with all attendees		
	Train facilitator (if needed)		
	Schedule the meeting		
	Rehearse using the equipment		
	Secure a headset and microphone		
	Establish and disseminate a back-up plan to all attendees		
	Make information and resources available and easily accessible to all attendees		
	Ensure appropriate lighting is in place		
	Provide materials to attendees ahead of time		
	Ensure a level of comfort with the technologies being used		
	Provide an opportunity for attendees to familiarize themselves with the technologies within the videoconference system		

During the Videoconference Meeting	Arrive at least 15 minutes early to the meeting		
	Introduce or have introductions of all attendees		
	Make initial eye contact with all attendees		
	Point out all the features of the videoconference system to the attendees		
	Review the back-up plan in case of technical difficulties		
	Review proper etiquette (e.g., talk to the camera, use microphones, avoid sudden movement & noises, speak naturally, be conscious of body language, posture and facial expressions, etc.)		
	Be prepared to stay for the entire duration of the meeting		
	Ensure that all attendees' electronic devices are turned off (e.g., cellular phones, pagers, etc.)		
	Review where facilities, phones and fire exits are at local and remote sites		
	Talk to the cameras		
	If appropriate: -Establish a steering committee -Address technology literacy and troubleshooting techniques -Set objectives, vision, goals and/or outcomes for collaboration -Review positive outcomes of previous meeting -Discuss rewards and consequences for collaborative efforts		
After the Videoconference Meeting	Discuss and agree upon a follow-up procedure with all attendees		
	Thank all attendees for their participation		
	Ensure that the system is disconnected from the remote site(s)		
	turn off all appropriate monitors and peripherals follow up the meeting with all attendees via asynchronous or synchronous communications		
	Ensure that the contact person knows when the meeting is complete		
	Ensure room/area is secure before leaving		

Appendix C: Information and Consent Letter

Information and Consent Letter

Dear Prospective Participant,

We have been informed that you will be participating in a video conference meeting at the University of Alberta's Cyberport! You are hereby invited to participate in a research initiative that is being funded by Social Sciences and Humanities Research Council of Canada (SSHRC). With this research initiative, we are examining real-time research collaboration within a video conference environment. One of my graduate students, Karen Fiege, will also be involved in this project. The rationale behind this research initiative is to evaluate your personal reactions, thoughts and attitudes towards your videoconference experience.

The time commitment from you will be kept to a minimal. We would like to set up an interview lasting between five to ten minutes. We would like this interview to be recorded in order for us to store the data and later transcribe what you have said for publication purposes.

We will personally secure all data that is collected. Your identity will remain anonymous and all information provided to us will remain confidential. No video images or recorded audio segments will be published. Your responses will be transcribed and used for publication purposes in academic journals, print articles, web postings or presentations at conferences or for teaching purposes.

Any transcript, data, images or video recordings adhere to the University of Alberta Standards for the Protection of Human Research Participants (http://www.ualberta.ca/~unisecr/policy/sec66.html). If for any reason any additional researchers join this research initiative, they will be obligated to sign a confidentiality agreement. This interview should not cause any personal harm, nor will it generate any foreseeable personal benefits.